CONTROLLING POLLUTION FROM CANADIAN PULP AND PAPER MANUFACTURERS:

A FEDERAL PERSPECTIVE

by

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Environment Canada

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FOREWORD

The public perception of pollution as a problem is dominated by a number of popular myths. One is that pollution is exclusively a 20th century phenomenon. Another widely accepted myth is that pollution is only of serious concern in affluent nations. Another is that the main cause of pollution is industrial processing. Still another related myth is that the main reason pollution is a problem is that the free enterprise system permits captains of industry to impose their waste discharges on the larger population. In all of these, there are some very basic facts being ignored. For example, the drinking water of Rome is known to have been at least slightly polluted before the first century. Pollution is known to run rampant in India where per capita income is dismally low when compared to North America. Some of the world's dirtiest air hangs over Eastern European cities that are neither affluent nor part of what is considered the free enterprise system. Within certain jurisdictions, the amount of pollution generated by individual activity (i.e. driving cars, throwing away garbage, burning trash, etc.) exceeds the pollution generated by industry. In one way or another virtually all of man's activities contribute in some degree to pollution.

However, it is not the existence of these popular and inaccurate notions that is the main source of concern for those attempting to reduce pollution. In an area of human pursuit as complicated and technically complex as pollution control, it is understandable that some misconceptions would exist. What is important is the fact that general belief in these myths often result in some very serious misunderstandings about the responsibility of government and the role of industry in limiting waste discharges. In this regard, it should be recognised that the responsibility for reducing waste discharges does not rest solely with government. Every citizen of every nation has some individual responsibility for reducing pollution for the common good. All of the world's pollution problems cannot be blamed on industrial leaders who are obsessed with adopting new technology only to make a profit. Industrial leaders are not given to insensitivity to any greater extent than the general population. There are industrial leaders that are environmentally irresponsible, just as there are private individuals who do not act responsibly. Industry has no greater incentive to pollute than does the private individual. Some industrial processes benefit economically from containing waste discharges for reuse in their production process or to produce additional products. There is no evidence to suggest that modern technology will inevitably lead to an ever increasing amount of pollution. It could be argued that industrial and technological development, rather than being the source of the problem, may actually provide the solution in the future. Government and industry working together have made some very major advances in reducing the pollution during this century. So much so, that it can be argued that the amount of pollution discharged per capita may have actually declined in modern times.

It should be cautioned that the intention here is not to suggest that pollution has not advanced to the stage where it poses a serious threat to mankind. There is no question that industrial pollution is, as it will continue to be, an ever increasing problem as the world's population grows and natural resources become more scarce. Governments do have a responsibility to act on behalf of their citizens to protect the environment. What is being suggested is that the amount of pollution society is willing to accept is the collective choice of individuals and not of government and industry. The analysis contained in this report will show that the Canadian pulp and paper industry has reduced waste discharges quite considerably over the last fifteen years. Governments have played a substantial role in helping the pulp and paper industry achieve these reductions. The decision on whether these reductions are great enough to satisfy the environmental interests of the general public rests with Canadians. This report sets out some of the options available, and points to the trade-offs involved, in an attempt to help Canadians determine the course they wish to set for future.

D.K. Dawson
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July 1988

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My debt to many is substantial. However, it would be misleading to suggest the approach adopted, or the conclusions and recommendations in the report enjoy the support of all those who have provided help. It is anticipated that almost everyone who reads this report will find things with which they disagree. This need not detract from the worthiness of

this presentation. I am satisfied that it reflects accurately the circumstances of the pulp and paper industry at the present time. A critical review of the report's contents in the appropriate atmosphere might add to the ultimate value of this effort. In any case, acknowledgement of help does not imply endorsement of contents or responsibility for error. Deficiencies in format, inaccurate use of the material provided, or errors in judgement are my sole responsibility.

William F. Sinclair
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Appendix I

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INTRODUCTION

Within the organisational framework of the Department of Environment, Conservation and Protection manages three broadly based national activity components. These three national activity components are Environmental Protection, Inland Waters, and Wildlife. Each is comprised of a number of sub-activities, which together account for a substantial portion of the Federal Government's total commitment to the environment. Within this broad framework, the Department of Environment, through Environmental Protection administers a set of industry regulations and guidelines that are designed to address the pollution problems as they relate to specific industrial product processes. The legislative authority for these efforts are prescribed under Section 33 of the Canada Fisheries Act, and includes six types of manufacturing and processing establishments. These are pulp and paper mills, metal mines, petroleum refineries, chlor-alkali mercury plants, and potato, meat, poultry processing plants. Of the six types of processes covered by pollution control regulations and guidelines, the oldest and perhaps most extensive in terms of both economic importance and overall impact are those directed at the pulp and paper industry.

The purpose of this study is to assess the progress that has been made in pollution control in the Canadian pulp and paper industry as a result of the federal pulp and paper effluent pollution regulations of 1971[1] and the air emission guidelines that were established in

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[1] The Pulp and Paper Effluent Regulations, Regulations, Codes and Protocols Report EPS1-WP-72-1, Water Pollution Control Directorate, November 1971.

1979.[2] The study will include: (1) an historical review of the industry processes used to produce pulp and paper in Canada, (2) an examination of the mandate and the stated objectives of federal efforts to control pollution generated by the industry, (3) an analysis of the need for continuing federal involvement in regulating pollution caused by the pulp and paper industry, (4) an assessment of discharge reductions achieved, (5) an evaluation of the efficiency of the regulations as they are currently administered, and finally (6) drawing conclusions, and as appropriate, making recommendations on the basis of the evidence and findings of this study.

Even though the primary purpose is to determine the industry's performance in terms of the overall federal contribution in helping to reduce the pollution caused by the industry, there are a number of practical realities that have governed both the focus and direction of the evaluation undertaken in this study. The first, and perhaps most important of these, are the practical problems associated with determining program success. The true test of how well living systems are being protected is in the impact that waste discharges have on the environment. The mills that have the highest loadings are usually considered the worst mills because of the way waste discharges are perceived and the regulations as they are specified, but they may not be the most destructive if we take into account the receiving environment. It also is true that society's ability to deal with industrial pollution depends on our ability to define the total of the problem. Environmental agencies in Canada monitor, and indeed measure, only those substances that are known to pose a threat to the environment or to human health. There is not always sufficient information to assess the degree of problems associated with some potentially harmful wastes that result from the various refinements in the processes used to produce the products manufactured in the industry. Indeed, some wastes which are thought to be harmful eventually may be found relatively harmless. Therefore this study, like all other studies of similar nature, is limited by the current state of scientific knowledge about living systems and our understanding about the impact that changing technologies may have on the environment.

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[2] "Wood Pulping Industry National Emission Guidelines for New Stationary Sources", Canada Gazette, Part I, September 22 1979.

Second, there are the practical problems of assessing the actual contribution from particular sources. As discussed in Chapter Three, the jurisdictional responsibilities for the environment are divided between the federal and provincial governments through a broadly defined constitutional framework that is often interpreted through the courts. The environmental legislation that is in place is based on recognised jurisdictional authority, rather than on clearly defined focuses of concern.[3] For example, an examination of existing federal environmental legislation almost certainly would convey the false impression that the Federal Government has relatively minor concern for human health and a disproportionate concern for fisheries over other resources. However, when examined in a somewhat broader perspective, it can be seen that the protection of fish and fish habitat not only serves to protect a resource over which the Federal Government has strong jurisdiction, but it provides a first line of defence for protecting human health by maintaining water quality to a level that safeguards fish populations.[4] Thus, the federal legislation that has been adopted is meant to compliment similar legislation at the provincial levels so that it is consistent with the respective jurisdictional authorities of the two levels of government under the constitution. The overall intention is that the total of federal and provincial legislation which is in place provides Canadians with a level of environmental control commensurate with what is necessary to protect Canadians without excessive overlap between the two levels of government, or imposing unacceptably high economic and social costs at the regional or local levels. It follows, therefore, that any program designed to examine the success of environmental control measures must take into account the work of both the federal and provincial governments, as well as the efforts of those most directly affected by the control measures that have been adopted. Since it is almost impossible to identify who might be responsible for individual successes or failures for controlling pollution within the industry, the precise contribution of specific programs cannot be determined. Accordingly, the contribution of Environmental Protection in controlling waste discharges from pulp and paper mills are assessed in terms of the combined efforts of the two levels of government and industry.

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[3] James W. Parlour, "The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations 1970," Journal of Environmental Management, Academic Press Inc., London, Vol. 13, pp.127-149.

Third, there are the practical constraints of focusing on those areas of concern that are of greatest significance in terms of controlling industry pollution. The analysis contained in this report includes within it a review of both effluent discharges into water as well as common contaminants emissions into air. The obvious need to include some assessment of air emissions stems from the fact that Environment Canada administers ambient air quality guidelines for the pulp and paper industry. There is little doubt that there are many adverse conditions that can result from pulp and paper mill air emissions. However, the problems from such emissions are usually local in nature. The quantities of contaminants emitted by pulp and/or paper mills generally are below levels that could result in ambient air-borne concentrations which are toxic to man, animals or plants. Therefore, the federal guidelines as administered by Environmental Protection are ambient air quality minimum standards meant to assist the provinces set realistic limits which are appropriate to local geographic conditions.[5] Accordingly, the air contaminants emissions analysis contained in this report is not given the same emphasis as effluent discharges into water.

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[4] Minutes of the Proceedings of the Standing Committee on Fisheries and Forestry, April 30 1970, p.19.8.

Fourth, there are a number of problems that emanate from the limited amount of data that are available. As originally envisioned, this report was to contain information on the performance of individual mills in complying with federal regulations. This is an approach that is consistent with practices in other countries, most notably Sweden and Finland.[6] It is felt that when such information is made available to the public, it serves both the interest of the general public and that portion of industry which are performing well environmentally. However, the loadings information that is collected is only a reasonably accurate indication of the total volume of effluent discharge from individual mills over a calendar year. These effluent loadings measurements cannot be legally interpreted in terms of the standards prescribed in the regulations. Therefore, individual mills are not identified unless such information directly contributes to the analytical techniques adopted in the study. The information itself is not used to grade the performance of an individual mill or the industry, but to provide broad perspectives that contribute to a general understanding of the effectiveness of the legal and administrative instruments currently available and used by federal environmental authorities.

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[5] Minister of Environment as recorded in The Canada Gazette, Part I, September 22 1979, p.97.

[6] Report of the Special Working Group, Water Pollution Problems of Pulp and Paper Industries in Finland and Sweden, Committee for the Gulf of Bothnia, Naturvardsverket Rapport 3348, May 1987.

In this regard, it should be noted that the effluent discharge information contained in this report does not always correspond exactly with similar data from other sources. The mill discharge records of the Canadian Pulp and Paper Association and some provincial agencies vary with one another, and each also differs slightly from the estimates presented in this report. These variations in absolute numbers are small and statistically insignificant (usually less than .5 percent). Nonetheless, the reader should keep in mind that effluent discharge information, regardless of the figures reported by different sources, are estimates calculated from daily average loadings approximations, which are multiplied by the number of days a mill operated during a year to derive total annual loadings. The potential magnitude of error that can result from these procedures are many times greater than the differences which occur because of source variation. Although the reader should keep in mind that these differences exist, they do not alter the validity of the analyses or findings presented in this report.

This report is divided into six Chapters. Chapter One is used to provide a perspective on the past, present, and future importance of the pulp and paper industry in Canada. The historical development of the industry is traced through to present day. The current structure of the industry is examined, within the context of its overall importance regionally. The intention is to provide the background necessary for the analysis undertaken subsequently in the remainder of the report.

Chapter Two is used to assess the long-term trends within the industry in order to identify determining factors in overall environmental performance. The various types of pulping processes are discussed and each is examined in terms of its potential environmentally disruptive properties. The application and use of pollution control systems are discussed. The shared interests of society and government are examined with a view to assessing areas of mutual concern.

In Chapter Three, a review of the environmental mandate and responsibilities of the Federal Government is undertaken. The regulative procedures adopted in conjunction with provincial authorities are examined. The effectiveness of the regulations and guidelines are assessed within the context of the program structure that has been established. The difficulties encountered by those responsible for administering the regulations are discussed. This assessment takes into account the views of both industry and the public, as recorded in the reviews, studies, and critiques made by different interest groups.

Chapter Four is used to provide an examination of accomplishments which can be attributed to federal regulatory efforts. The effectiveness of the pulp and paper effluent abatement regulations and air emission guidelines are examined in terms of regional impact. Effluent loadings and common air emission reductions are presented. The accomplishments which have been made in conjunction with the provinces and industry are subjectively evaluated.

In Chapter Five the future prospects of reductions using the pulp and paper regulations as currently specified and administered are examined. Industry and provincial agency views of the federal role are discussed. The changing circumstances within the industry are reviewed. International and domestic attitudes towards industry pollution are assessed in terms of their long-term implications on controlling pollution within the pulp and paper industry in Canada.

Chapter Six is used to assess the economic and social implications of current administrative procedures. The economic circumstances which give rise to the need for government intervention in controlling industry pollution are discussed. The limits for optimising the tradeoffs between economic prosperity and environmental controls are defined in terms of the objectives of the federal regulations. Estimates on the cost to mills are presented and discussed within the context of potential impact on international competitiveness. The consultative patterns which have been adopted are reviewed and critically examined on the basis of cyclical patterns and the discharge control standards specified in the regulations. Government assistance programs also are reviewed in this Chapter.

In what follows, the terms "pulp and paper industry" and "industry" are used interchangeably to refer to the collective group of establishments that use wood fiber to manufacture pulp, paper, and other synthetics. The mills or establishments included in this category are treated as a homogeneous group of manufacturers that are producing a readily identifiable group of products. However, it should be noted that the pulp and paper industry is not a homogeneous collection of production units as is commonly perceived. It is in fact a complex industry that uses a variety of mechanical and chemical processes to manufacture a wide variety of different products. Mills using exactly the same processes may produce different products for different markets by using different process variations and sequences. The industry produces pulp as part of an integrated process that serves as a factor input for producing other final products, but it also produces market pulp which is sold in highly competitive domestic and international markets. The products produced in the industry includes everything from buttons to explosives. They include synthetic clothing and newsprint. The industry produces wallboard, insulation for construction, cardboard, coarse paper, paper for printing, writing paper, and tissues. Even though the phrase "pulp and paper industry" is used in a manner consistent with the way it is most often interpreted, the reader should bear in mind that it is a complex industry about which it is difficult to generalise. The complex and diverse nature of the industry does add considerably to the difficulties encountered in completing the analyses described in this report.

The terms "toxicity to fish" and "acute toxicity" are used interchangably to refer to acute lethality to fish. The sublethal and chronic effects of effluent loadings are not encompassed within the intended meaning of these terms. The term "compliance" is used descriptively as an indicator of perceived adherence to the standards specified in government regulations. As used throughout this report, the term "compliance" should not be interpreted as having any legal connotation. Neither does it relate in any way to the compliance policy of the Department of the Environment. The terms "effluent discharge", "discharge", and "loadings" also are used interchangably to refer to water related waste releases which are environmentally disruptive. "Pollution" and "waste discharges" are used to refer to both air emissions and waste effluent releases. The use of jargon or esoteric terms having limited specific meanings are avoided. In those few cases where jargon is used, it is either defined in footnote or can be readily interpreted within the context of the discussion.

The data used in this report was obtained from a number of different sources. These include provincial and federal government authorities (both at headquarters and at the regional levels), industry associations, mill representatives, and general reference material. Even though most of the information used in this analysis is for 1985, these data are often the latest data available and do not affect the accuracy of the findings or conclusions in terms of existing circumstances within the industry. All material used in this report is referenced according to source, and cautionary remarks about the accuracy and consistency of the data are footnoted as appropriate. The major sources used, the methodologies employed, the analytical approaches that have been utilised, as well as comments on accuracy of data are provided in Appendix I.

The discussion and analyses contained in this report cover a wide range of topics and areas of specialisation. As a result, there is potential for some, or even many, individuals to take exception to some of the general interpretations based on the professional work of others. If this were a concern, which was accepted as reason for not including biological, engineering, economics, social, legal, and public administration considerations in one study, then such work would never be undertaken. Engineers do not always agree, biologists do not, lawyers do not, and neither do economists. Every effort has been made to ensure that this document provides an accurate interpretation of the expert sources cited in the report. Differing expert opinions are always examined and compared with other available information. Variations in opinions are noted in the report as deemed appropriate. The only differing views which might affect the findings (i.e. within the scope and context of the information used in this study) is the differing opinions on the affect that reduced water usage has on industry's ability to control toxicity. Scientific analytical procedures, based on hypothesis testing, were used to develop the positions taken in this report.

This presentation should not be used for other than its intended purpose. This is not a technical or biological report. As was specified by those responsible for setting the terms of reference for this study, it is meant as an impartial and objective overview of federal efforts to control pollution from the pulp and paper industry over the years since 1971. It is hoped that the reader will agree that this same impartiality and objectivity was used when examining the role that industry has played. The views, findings, and conclusions contained in this report are not necessarily endorsed or supported by the Department of the Environment or by those senior government officials responsible for the ultimate use of the analysis contained herein.

CHAPTER ONE

The Canadian Pulp and Paper Industry: An Overview of Its Development, Economic Importance, and Future Significance

The purpose of this Chapter is to provide a description of the Canadian pulp and paper industry using a perspective that outlines the past, present, and future economic and social importance of the industry to Canada. In what follows, the interrelationship between business cyclical fluctuations and the observed behavioural patterns of industry are examined. Emphasis is placed on the role that the industry has played in helping establish Canada as a nation that can successfully manufacture products which enjoy long-term international market acceptance. The potential environmental impacts of pulp and paper production will be described. Some attention will be devoted to describing the historical relationship between government and industry. As appropriate, the information on the Canadian pulp and paper industry will be viewed within the context of the international growth of the industry in North America and worldwide.

The Canadian Pulp and Paper Industry

The Canadian pulp and paper industry is comprised of 82 operating firms (see Appendix III), which operate 149 mills (122 direct discharge mills)[1] in nine of Canada's ten provinces (see Map 1 and Appendix III). It is Canada's most economically important industry. It

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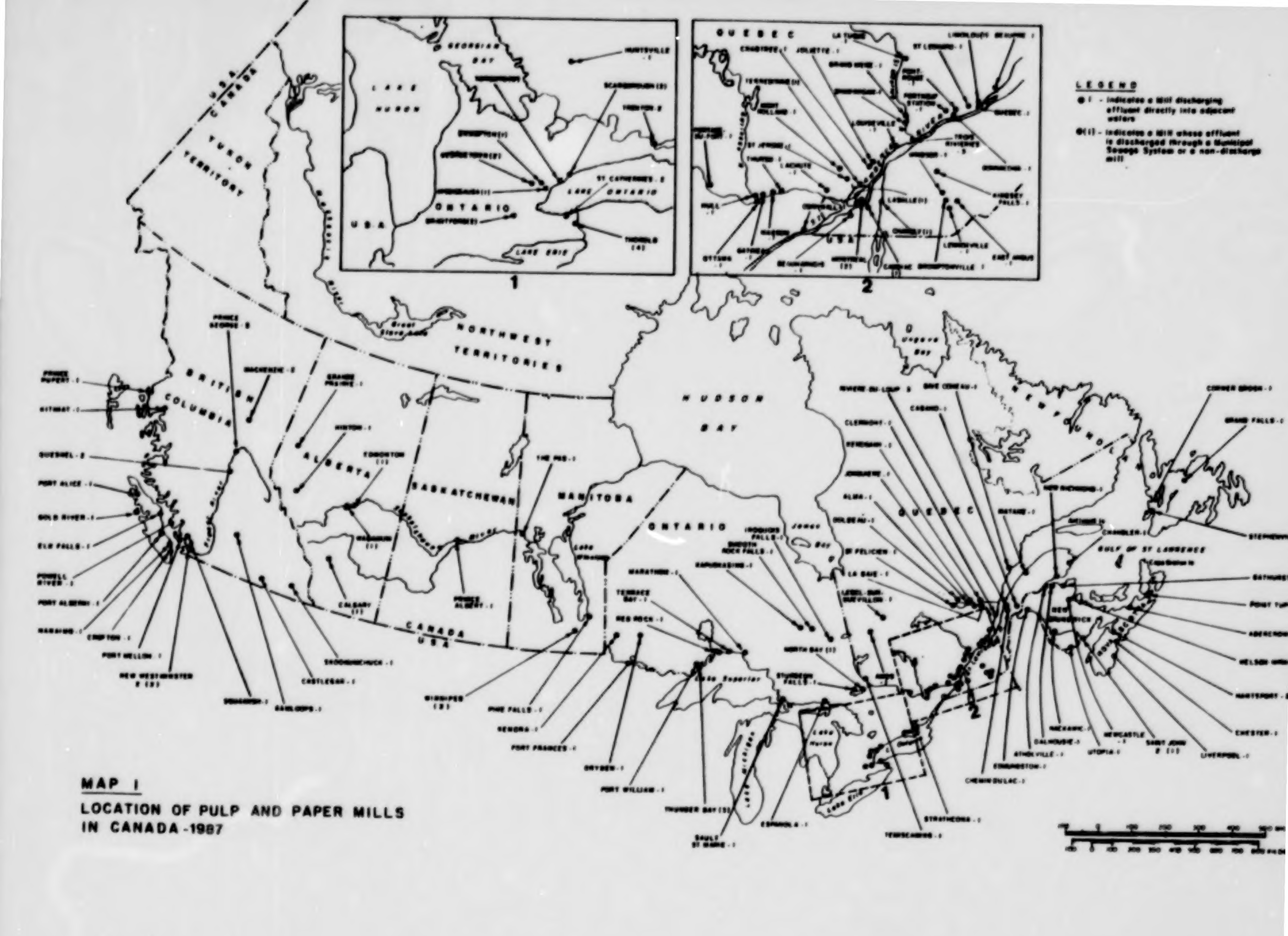
[1] A direct discharge mill is one which discharges its effluent waste directly into an ocean, lake, river or stream without going through a municipal sewage system.


LEGEND
● I - indicates a Mill discharging effluent directly into adjacent waters
●(I) - indicates a Mill whose effluent is discharged through a Municipal Sewage System or a non-discharge mill
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
NEWFOUNDLAND
NEW BRUNSWICK
NOVA SCOTIA
HUDSON BAY
James Bay
Ungava Bay
GULF OF ST LAWRENCE
CANADA
U.S.A.
LAKE HURON
GEORGIAN BAY
LAKE ONTARIO
LAKE ERIE
Lake Superior
Lake Michigan
1
2
PRINCE RUPERT - 1
KITIMAT - 1
QUESNEL - 2
PORT ALICE - 1
GOLD RIVER - 1
ELK FALLS - 1
POWELL RIVER - 1
PORT ALBERNI - 1
NANAIMO - 1
CROFTON - 1
PORT MELLON - 1
NEW WESTMINSTER 2 (1)
SQUAMISH - 1
KAMLOOPS - 1
CASTLEGAR - 1
SKOOKUMCHUCK - 1
PRINCE GEORGE - 3
MACKENZIE - 2
GRANDE PRAIRIE - 1
HINTON - 1
EDMONTON (1)
CALGARY (1)
PRINCE ALBERT - 1
THE PAS - 1
WINNIPEG (2)
PINE FALLS - 1
KENORA - 1
FORT FRANCES - 1
DRYDEN - 1
RED ROCK - 1
TERRACE BAY - 1
MARATHON - 1
PORT WILLIAM - 1
THUNDER BAY (3)
SAULT ST MARIE - 1
ESPANOLA - 1
KAPUSKASING - 1
IROQUOIS FALLS - 1
SMOOTH ROCK FALLS - 1
STURGEON FALLS - 1
NORTH BAY (1)
TEMISCAMING - 1
STRATHCONA - 1
HUNTSVILLE - 1
SCARBOROUGH (2)
TRENTON - 2
ST CATHERINES - 2
THOROLD (4)
BRANTFORD (2)
LA TUQUE
ST LEONARD
QUEBEC
LOUISEVILLE
TROIS RIVIERES
WINDSOR
KINGSEY FALLS
EAST ANGUS
BROMPTONVILLE
CABANO
CANDIAC
MONTREAL
BEAUHARNOIS
OTTAWA
GATINEAU
HULL
THURSO
LACHUTE
ST JEROME
MONT ROLLAND
TERREBONNE (1)
CRABTREE - 1
JOLIETTE - 1
GRAND MERE
RIVIERE DU LOUP - 3
BAIE COMEAU - 1
CABANO - 1
CLERMONT - 1
KENOGAMI - 1
JONQUIERE - 1
ALMA - 1
DOLBEAU - 1
ST FELICIEN - 1
LA BAIE - 1
LEBEL-SUR-QUEVILLON - 1
MATANE - 1
NEW RICHMOND - 1
CHANDLER - 1
CORNER BROOK - 1
GRAND FALLS - 1
STEPHENV
BATHURS
POINT TU
ABERCROM
NELSON MIR
HANTSPORT - 1
CHESTER - 1
LIVERPOOL - 1
SAINT JOHN 2 (1)
NEWCASTLE - 1
UTOPIA - 1
NACKAWIC - 1
DALHOUSIE - 1
ATHOLVILLE - 1
EDMUNDSTON - 1
CHEMIN DU LAC - 1

MAP I

LOCATION OF PULP AND PAPER MILLS IN CANADA - 1987 stands first among all Canadian industry in value of production and total wages paid. It ranks second only to the steel industry in exports. It ranks third in terms of total value of shipments, and is among the top four in total capital investment. It is one of the largest consumers of electrical energy, and buyers of goods and services in the nation. As shown in Table 1:1, over the past 35 years the industry has accounted for between 5.3 and 2.9 percent of Canada's gross national product. Table 1:2 shows that during the same 25 year period, the value of pulp and paper exports has represented between 23 and 8.4 percent of all domestic exports. As revealed in Table 1:3, the industry is one of the world's largest pulp and paper producers. In 1985, it accounted for roughly fifteen percent of the world's pulp production and about 32 percent of its total newsprint production. The industry produces about three percent of the world's output of other paper and paperboard products.[2] As shown in Table 1:4, during the 35 year period commencing in 1951, the pulp and paper industry exported between a high of 76.7 and low of 69.1 percent of the total value of its total production. Canadian pulp and paper is sold in every major market area of the world including the Far East, Africa, Western Europe, Latin America, and the United Kingdom.

The Importance of the Industry

The importance of the industry to Canadians cannot be measured solely in terms of economics. The industry's continued presence in every region, over a long period of time extending back to before Canada became a confederation, has a social significance that contributes to a distinct-

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[2] Reference Tables, Canadian Pulp and Paper Association.

TABLE 1:1

PULP AND PAPER PRODUCTION AS A PERCENTAGE OF GROSS NATIONAL PRODUCT 1950 - 1985

Year	Gross Domestic Production of Pulp and Paper Mills ($'000,000)	Gross National Product ($'000,000)	Pulp and Paper Production as a % of GNP
1950	954	18,006	5.3
1955	1,327	27,132	4.8
1960	1,583	36,287	4.4
1965	2,109	52,203	4.0
1970	2,862	85,685	3.3
1975	5,159	165,343	3.1
1980	10,991	297,556	3.7
1985	13,391	456,112	2.9

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

TABLE 1:2

VALUE OF PULP AND PAPER EXPORTS AS A PERCENTAGE OF TOTAL DOMESTIC EXPORTS 1950 - 1985

Year	Pulp and Paper Exports ($'000)	Total Domestic Exports ($'000)	Pulp & Paper Exports as Percent of Total Domestic Exports
1950	713,870	3,118,387	22.9
1955	991,543	4,281,784	23.2
1960	1,123,824	5,255,575	21.4
1965	1,442,097	8,525,078	16.9
1970	2,063,365	16,491,091	12.5
1975	3,876,712	32,466,068	11.9
1980	8,462,161	74,445,976	11.4
1985	10,030,699	119,474,500	8.4

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

TABLE 1:3

CANADA'S SHARE IN WOOD PULP AND NEWSPRINT PRODUCTION RELATIVE TO TOTAL WORLD PRODUCTION

1950 - 1985

Year	World Production of Wood Pulp ('000 tonnes)	Canada's Production of Wood Pulp ('000 tonnes)	Canada's Production of Wood Pulp as a % of World Production	World Production of Newsprint ('000 tonnes)	Canada's Production of Newsprint ('000 tonnes)	Canada's Production of Newsprint as a % of World Production
1950	38,162	8,473	22.2	9,535	5,279	55.4
1960	66,627	11,431	17.5	13,568	6,113	45.1
1970	59,580	10,397	17.5	21,170	7,909	37.4
1980	129,272	20,687	16.0	25,182	8,625	34.3
1983	129,102	20,030	15.5	25,267	8,485	33.6
1985	135,891	20,419	15.1	27,888*	8,988*	32.2*

* Preliminary estimate

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

TABLE 1:4

THE VALUE OF PULP AND PAPER EXPORTS AS PERCENTAGE OF GROSS PRODUCTION 1951 - 1985

Year	Gross Pulp and Paper Production ($'000,000)	Pulp and Paper Exports ($'000,000)	Exports as % of Gross Production
1951	1,238	939	75.8
1956	1,453	1,046	72.0
1961	1,633	1,152	70.6
1966	2,298	1,588	69.1
1971	2,835	2,058	72.6
1976	6,124	4,507	73.6
1981	11,709	8,984	76.7
1983	11,025	8,039	72.9
1985	13,391	10,090	75.4

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

ly Canadian heritage. For example as shown in Tables 1:5(A) and 1:5(B), the industry directly accounts for somewhat less than one percent of Canada's total employment. In fact, direct employment in pulp and paper production has not accounted for a very large portion of total national employment during any part of the last fifteen years shown on these Tables. Nonetheless, when taking into account the direct, indirect, and induced employment affects of the industry, it can be estimated to generate between 275,000 and 300,000 jobs within Canada as a whole.[3]

The pulp and paper industry could be considered crucially important in British Columbia, New Brunswick, and Northern Ontario, but it is a major industrial component in every region of Canada with the exception of Prince Edward Island and Southern Saskatchewan. It is the single most important industry in many large communities, such as Prince George in British Columbia, which has a resident population of approximately 67,000 people. It is the most important or only source of income for about 175 different towns or communities, with combined resident populations of about 250,000 people (see Map 2).[4] About 90 percent of the industry's manufacturing capacity is located in towns and cities of less than 100,000 people.[5] Nearly 50 percent of the manufacturing capacity of the pulp and paper industry is located in communities having populations of less than 10,000. Many towns or communities were established as

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[3] Estimates developed in consort with Statistics Canada personnel using The Input-Output Structure of the Canadian Economy, Catalogue 15-201E, System of National Accounts, Annual Publication, Minister of Supply and Services of Canada, Ottawa.

[4] Estimates are based on information taken from Single Sector Communities, Goverment of Canada, Regional Economic Expansion, Occasional Papers, 1979.

[5] K.E.A. de Silva, Pulp and Paper Modernization Grants: An Assessment, Economic Council of Canada, Discussion Paper No. 350, Ottawa, May 1988.

TABLE 1:5(A)

PULP AND PAPER INDUSTRY EMPLOYMENT[1] BY AREA IN CANADA AND AS A PERCENTAGE OF THE TOTAL AVERAGE EMPLOYMENT BY REGION

1969 - 1984

	Quebec			Ontario			Canada		
Year	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total
1969	29	2,126	1.36	22	2,979	.74	75	7,919	.95
1971	30	2,175	1.38	21	3,113	.68	79	8,344	.95
1973	29	2,330	1.25	21	3,380	.62	80	8,761	.91
1975	32	2,434	1.32	21	3,576	.59	84	9,284	.90
1977	32	2,476	1.29	22	3,643	.60	85	9,651	.88
1979	32	2,619	1.22	23	3,993	.58	87	10,395	.84
1981	33	2,726	1.21	23	4,171	.55	88	10,005	.88
1983	31	2,642	1.17	21	4,096	.51	79	10,734	.74
1984	31	2,722	1.14	20	4,243	.47	79	11,000	.72

[1] Average monthly employment figures for both sexes 15 years of age and older.

[2] Atlantic and Prairie Provinces include Nfld., P.E.I., N.S., N.B., Man., Sask. and Alta.

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry, Statistics Canada, Catalogue 71-201.

TABLE 1:5(B)

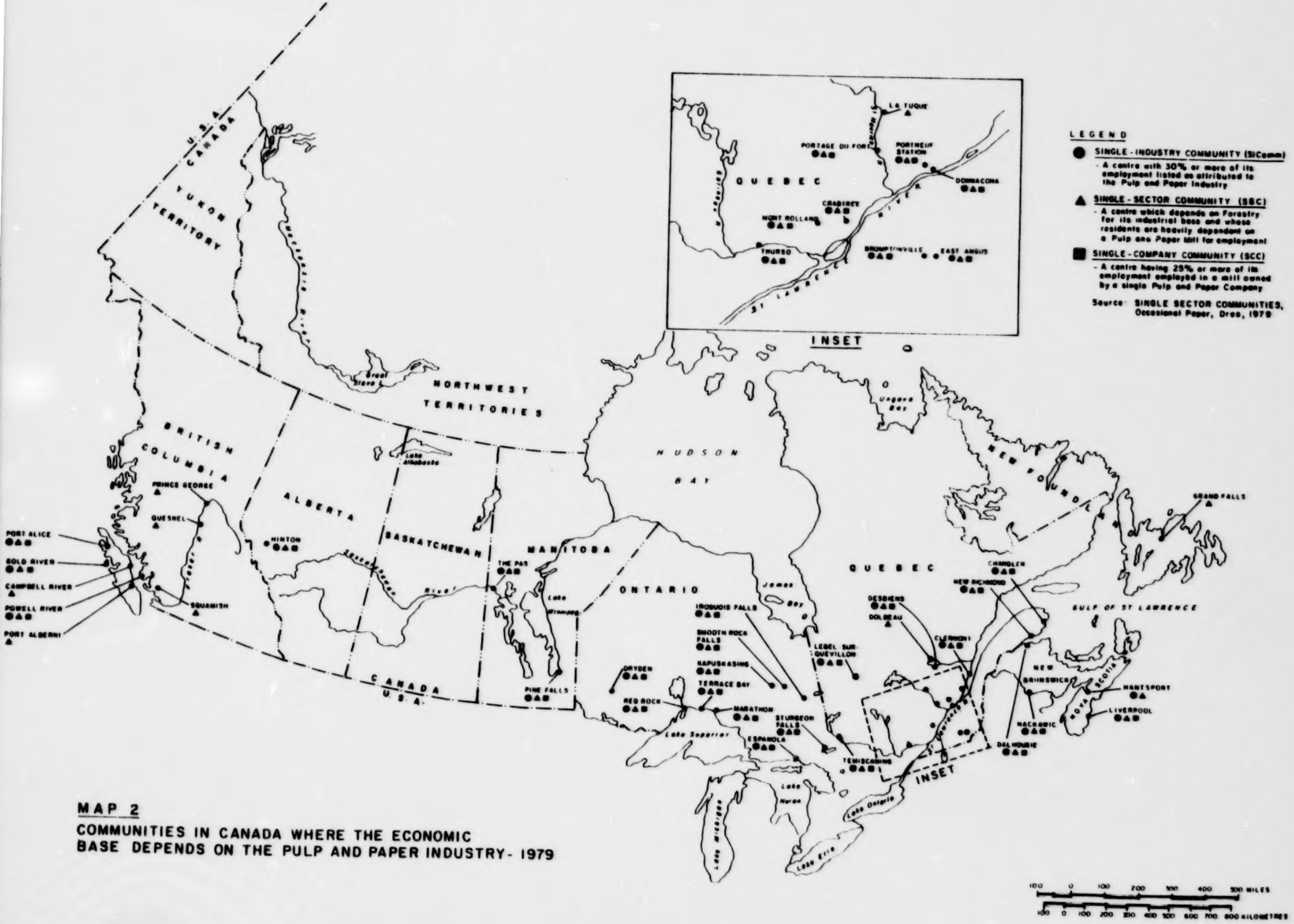
PULP AND PAPER INDUSTRY EMPLOYMENT[1] BY AREA IN CANADA AND AS A PERCENTAGE OF THE TOTAL AVERAGE EMPLOYMENT BY REGION 1969 - 1984

	Atlantic and Prairie Provinces[2]			British Columbia			Canada		
Year	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total	Industry Employment ('000)	Total Employment ('000)	% of Industry to Total
1969	11	1,938	.57	14	788	1.78	75	7,919	.95
1971	12	2,002	.60	16	834	1.92	79	8,344	.95
1973	13	2,130	.61	17	920	1.85	80	8,761	.91
1975	13	2,282	.57	18	995	1.81	84	9,284	.90
1977	13	2,424	.54	18	1,050	1.71	85	9,651	.88
1979	14	2,650	.53	19	1,144	1.66	87	10,395	.84
1981	14	2,839	.49	18	1,270	1.42	88	10,005	.88
1983	12	2,804	.43	16	1,197	1.34	79	10,734	.74
1984	13	2,835	.46	16	1,202	1.33	79	11,000	.72

[1] Average monthly employment figures for both sexes 15 years of age and older.

[2] Atlantic and Prairie Provinces include Nfld., P.E.I., N.S., N.B., Man., Sask. and Alta.

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry, Statistics Canada, Catalogue 71-201.


LEGEND
● SINGLE-INDUSTRY COMMUNITY (SiComm)
- A centre with 30% or more of its employment listed as attributed to the Pulp and Paper Industry
▲ SINGLE-SECTOR COMMUNITY (SSC)
- A centre which depends on Forestry for its industrial base and whose residents are heavily dependent on a Pulp and Paper Mill for employment
■ SINGLE-COMPANY COMMUNITY (SCC)
- A centre having 25% or more of its employment employed in a mill owned by a single Pulp and Paper Company
INSET
QUEBEC
LA TUQUE
PORTAGE DU FORT
PORTNEUF STATION
DONNACONA
CRABTREE
MONT ROLLAND
THURSO
BROMPTONVILLE
EAST ANGUS
ST LAWRENCE RIVER
U.S.A.
CANADA
YUKON TERRITORY
NORTHWEST TERRITORIES
Great Slave L.
BRITISH COLUMBIA
PRINCE GEORGE
QUESNEL
PORT ALICE
GOLD RIVER
CAMPBELL RIVER
POWELL RIVER
PORT ALBERNI
SQUAMISH
ALBERTA
HINTON
Lake Athabasca
SASKATCHEWAN
MANITOBA
THE PAS
PINE FALLS
Lake Winnipeg
HUDSON BAY
James Bay
Ungava Bay
ONTARIO
DRYDEN
RED ROCK
TERRACE BAY
MARATHON
KAPUSKASING
SMOOTH ROCK FALLS
IROQUOIS FALLS
LEBEL-SUR-QUEVILLON
STURGEON FALLS
ESPANOLA
TEMISCAMING
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
QUEBEC
DESBIENS
DOLBEAU
CLERMONT
NEW RICHMOND
CHANDLER
GULF OF ST LAWRENCE
NEW BRUNSWICK
NACKAWIC
DALHOUSIE
NOVA SCOTIA
HANTSPORT
LIVERPOOL
NEWFOUNDLAND
GRAND FALLS
100 0 100 200 300 400 500 MILES
100 0 100 200 300 400 500 600 700 800 KILOMETRES

Source: SINGLE SECTOR COMMUNITIES, Occasional Paper, Dree, 1979

MAP 2

COMMUNITIES IN CANADA WHERE THE ECONOMIC BASE DEPENDS ON THE PULP AND PAPER INDUSTRY - 1979 a result of pulp and paper manufacturing operations. A large number of these communities are located in remote or even isolated areas. Loss of income from pulp and paper manufacturing can have a devastating effect on the economic and social well-being of residents of regions or communities where pulp and paper manufacturing is the main source of income and employment.

The Economic Structure of the Industry

Although highly dependent on international markets, it is an industry which is largely Canadian owned. This is revealed by the information presented in Tables 1:6, 1:7, 1:8, and 1:9, which respectively show domestic controlled assets, equity, sales, and profits as a percentage for all of the industry over the period 1975 to 1984. The information in these Tables clearly shows that domestic ownership is large and has been growing over the nearly 30 year period ending in 1984.

Even though a major producer in world markets, the pulp and paper industry in Canada can be best described as a partial oligopoly,[6] which can have considerable influence on newsprint prices under tight market conditions.[7] However, the industry is for the most part a

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[6] A partial oligopoly is a situation where a few sellers dominate the selling side of the market for a product, but do not act to maximise joint profits because of uncertainties associated with other large sellers in the market. In the case of the pulp and paper industry, the heterogeneous nature of the products produced also helps prevent behaviour which maximises joint profits.

[7] Some feel that Canadian paper firms are collective price leaders while others claim that this is not so, and point to the fact that newspaper prices have only begun to rise after being stable over a number of years. While it is true that marginal producers can help to keep price levels down during slack market periods, it has (Continued on following p.29)

TABLE 1:6

DISTRIBUTION OF PULP AND PAPER INDUSTRY
ASSETS[1] BETWEEN DOMESTIC AND FOREIGN
CONTROLLED COMPANIES 1975 - 1984
(In millions of dollars)

Year	Total Assets in the Industry	Total Foreign Controlled Assets	Percentage of Foreign Controlled Assets to Total	Total Domestic Controlled Assets	Percentage of Domestic Controlled Assets to Total
1975	9,487	3,938	41.5	5,549	58.5
1976	9,942	3,824	38.5	6,118	61.5
1977	10,821	4,339	40.1	6,482	59.9
1978	11,620	4,426	38.1	7,194	61.9
1979	13,078	4,892	37.4	8,186	62.6
1980	14,515	4,994	34.4	9,521	65.6
1981	17,619	4,569	25.9	13,050	74.1
1982	18,917	4,458	23.6	14,459	76.4
1983	19,363	4,401	22.7	14,962	77.3
1984	20,606	4,623	22.4	15,983	77.6

[1] Assets include cash, marketable securities, accounts receivable, inventories, fixed assets investments in affiliated companies and other assets. The amounts tabulated above are shown on balance sheets of industry corporations after deducting allowances for doubtful accounts, amortisation, depletion and depreciation.

Source: Statistics Canada, Cansim data retrieval, 1987.

TABLE 1:7

DISTRIBUTION OF PULP AND PAPER INDUSTRY EQUITY[1] BETWEEN DOMESTIC AND FOREIGN CONTROLLED COMPANIES 1975 - 1984
(In millions of dollars)

Year	Total Equity In Industry	Total Foreign Controlled Equity	Percentage of Foreign Controlled Equity to Total	Total Domestic Controlled Equity	Percentage of Domestic Controlled Equity to Total
1975	4,294	1,671	38.9	2,623	61.1
1976	4,405	1,686	38.3	2,719	61.7
1977	4,757	1,871	39.3	2,886	60.7
1978	5,048	2,014	39.9	3,034	60.1
1979	6,089	2,232	36.7	3,857	63.3
1980	7,124	2,575	36.1	4,549	63.9
1981	7,362	2,151	29.2	5,211	70.8
1982	7,094	1,683	23.7	5,411	76.3
1983	7,194	1,576	21.9	5,618	78.1
1984	8,393	1,787	21.3	6,606	78.7

[1] Equity includes the shareholder's interest in the net assets of the corporation, and generally includes the total amount of issued and paid up share capital, earnings retained in the business and other surplus accounts such as contributed and capital surplus.

Source: Statistics Canada, Cansim data retrieval, 1987.

TABLE 1:8

DISTRIBUTION OF PULP AND PAPER INDUSTRY SALES[1] BETWEEN DOMESTIC AND FOREIGN CONTROLLED COMPANIES 1975 - 1984
(In millions of dollars)

Year	Total Industry Sales	Total Sales of Foreign Controlled Companies	Percentage Sales of Foreign Controlled Companies to Total Industry Sales	Total Domestic Controlled Companies Sales	Percentage of Domestic Controlled Companies Sales to Total Industry Sales
1975	6,196	2,493	40.2	3,703	59.8
1976	7,302	2,939	40.2	4,363	59.8
1977	8,377	3,385	40.4	4,992	59.6
1978	9,850	3,680	37.4	6,170	62.6
1979	12,840	4,872	37.9	7,968	62.1
1980	13,094	5,097	38.9	7,997	61.1
1981	14,500	3,774	26.0	10,726	74.0
1982	13,442	3,423	25.5	10,019	74.5
1983	14,675	3,697	25.2	10,978	74.8
1984	16,953	4,055	23.9	12,898	76.1

[1] Sales is gross revenue from non-financial operations and include only Canadian operated portion of operations are included in sales figures.

Source: Statistics Canada, Cansim data retrieval, 1987.

TABLE 1:9

DISTRIBUTION OF PROFITS[1], (LOSSES) IN THE PULP AND PAPER INDUSTRY BETWEEN DOMESTIC AND FOREIGN CONTROLLED COMPANIES 1975 - 1984

(In millions of dollars)

	Total Profits In The Industry	Total Foreign Controlled Company Profits	Percentage of Foreign Controlled Company Profits to Total Industry Profits	Total Domestic Controlled Company Profits	Percentage of Domestic Controlled Company Profits to Total Industry Profits
1975	690	323	46.8	367	53.2
1976	454	255	56.2	199	43.8
1977	493	245	49.7	248	50.3
1978	1,099	450	40.9	649	59.1
1979	1,490	414	27.8	1,076	72.2
1980	2,222	1,024	46.1	1,198	53.9
1981	1,856	469	25.3	1,387	74.7
1982	(167)	(23)	(13.8)	(144)	(86.2)
1983	(208)	(121)	(58.2)	(87)	(41.8)
1984	667	231	34.6	436	65.4

[1] Profits include net earnings from operations, investment income and net capital gains before taxes and after deducting amortization, depletion and depreciation.

Source: Statistics Canada, Cansim data retrieval, 1987.

price-taker, which often experiences modest or low profit margins.[8] The pricing practices of the industry are based on mark-ups on cost, which because of the nature of its manufacturing operations, practices price discounting when demand is low. This is at least partially revealed by the information presented in Figure 1:1, which shows cash earnings to sales and cost of sales to sales over the period 1972 to 1984. When cash earnings to sales are high, the cost of sales to sales are low and vice versa. In fact, the two ratios vary in what appears to be a directly inverse relationship. The strength of this relationship, in large degree can be attributed to price discounting within the industry.

It is a cyclical industry which experiences high peaks and low troughs. This is shown by the information presented in Figures 1:2 and 1:3 which show profit before taxes to equity, profit after taxes to equity, interest cost to total cost, and long-term debt to equity for the

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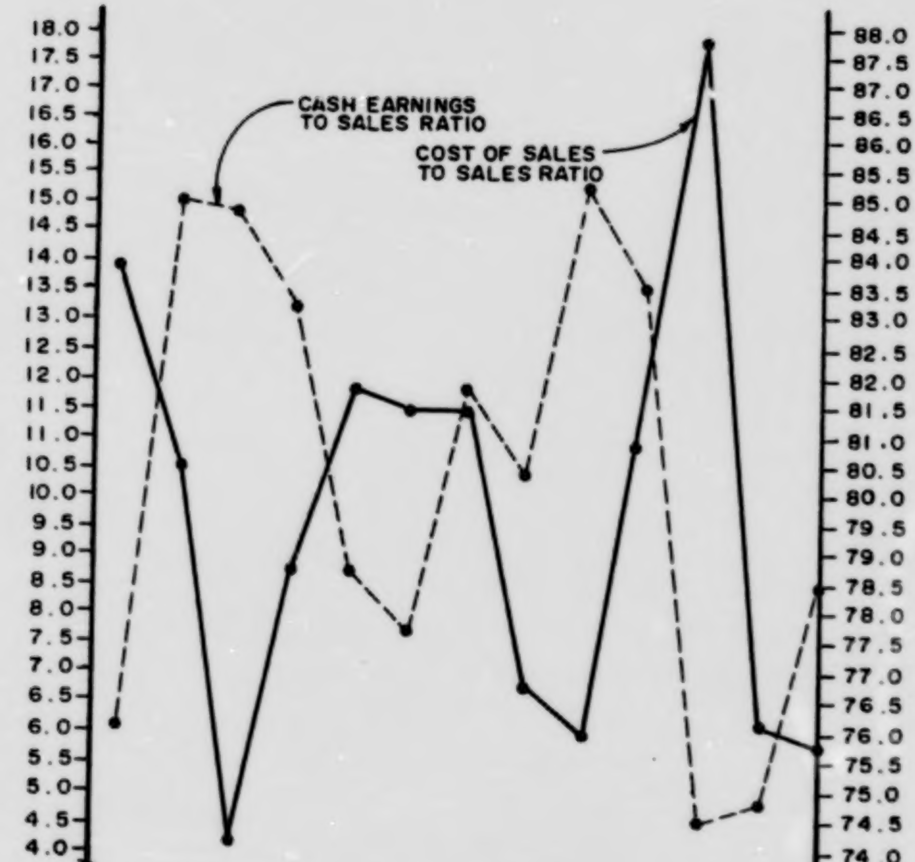
[7] (Continued) been observed that during recessions when the consumption of paper and paperboard products decline, the industry is able to maintain or sometimes even increase prices. A more realistic view might be that the industry is able to influence prices, but small marginal producers and backward integration with the newspaper media results in pressure to moderate prices. F.J. Anderson, Norman Bonsor, The Ontario Pulp and Paper Industry: A Regional Profitability Analysis, Ontario Economic Council, Research Study 32, Toronto, 1985. B.K. Singh, J.C. Nautiyal, "Factors Affecting Canadian Pulp and Paper Prices", Canadian Journal of Forest Research, Vol. 14, 1984, pp.683-691. Stuart U. Rich, Forest Products Journal, Vol. 28, No. 4, 6, 8, 1978.

[8] The observation that the industry is a price-taker and at the same time a partial oligopolist can be attributed to the buying practices in the marketplace. Newspaper producers tend to buy from the same sources because of quality control and product loyalty. However, if prices from the regular newsprint supplier get out of line with other suppliers, they will shift their business and take advantage of lower costs. It is of course more difficult to shift suppliers when the market is tight and demand is high. Ilan Vertinsky, W.T. Stanbury, The Pricing-Capacity Expansion Game in the North American Newsprint Industry: Preliminary Theoretical Speculations and An Applied Research Agenda, (unpublished), Faculty of Commerce and Business Administration, UBC, Vancouver, June 1986.

FIGURE 1:1

CASH EARNINGS[1] (LEFT AXIS) AND COST OF SALES[2] (RIGHT AXIS) TO SALES IN THE CANADIAN PULP AND PAPER INDUSTRY 1972 - 1984



1 Cash earnings to sales ratio is calculated as follows:

$$\frac{\text{Net profit after taxes, plus Amortization}}{\text{Product Sales}} \times 100\%$$

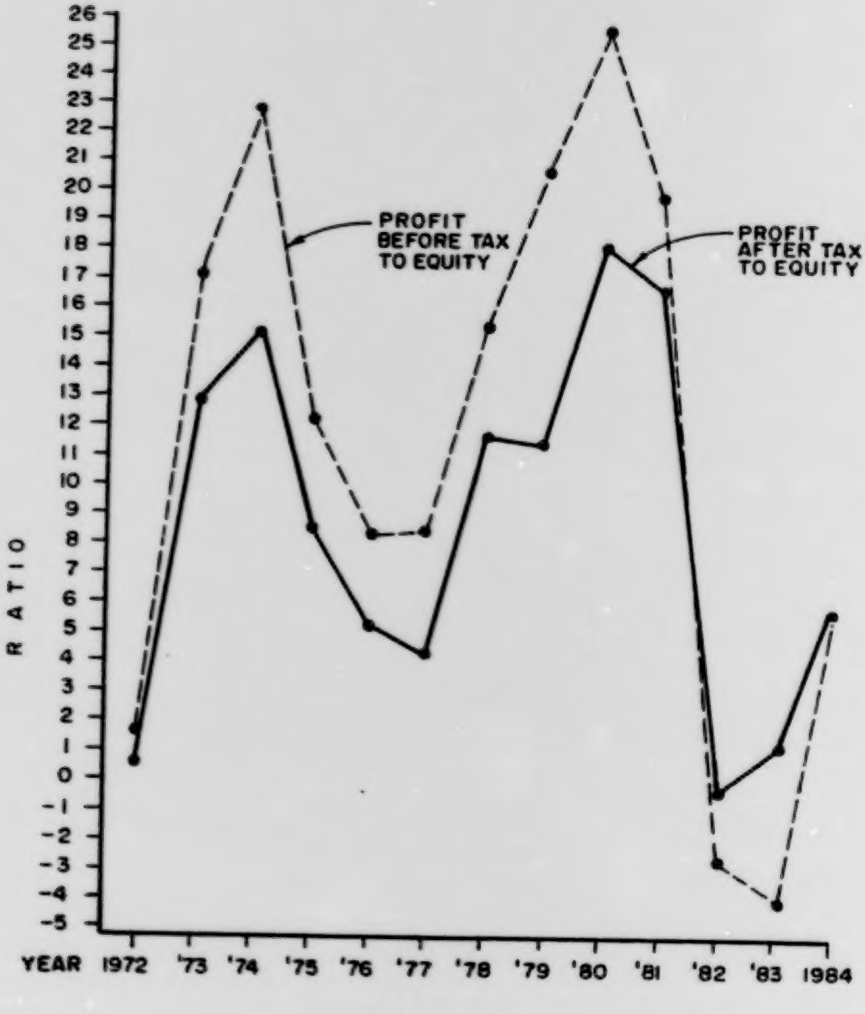
2 Cost of sales to sales ratio is calculated as follows:

$$\frac{\text{Cost of Sales}}{\text{Product Sales}} \times 100\%$$

Source: Statistics Canada Catalogue 61:207

FIGURE 1:2

PROFIT BEFORE[1] AND AFTER[2] TAX ON EQUITY FOR THE CANADIAN PULP AND PAPER INDUSTRY
1972 - 1984



1 Profit before tax on equity ratio is calculated as follows:

$$\frac{\text{Net profit before taxes and non-recurring items}}{\text{All non-current debt, remuneration or mortgages, due to shareholders or affiliated corporations, plus total equity}} \text{ X } 100\%$$

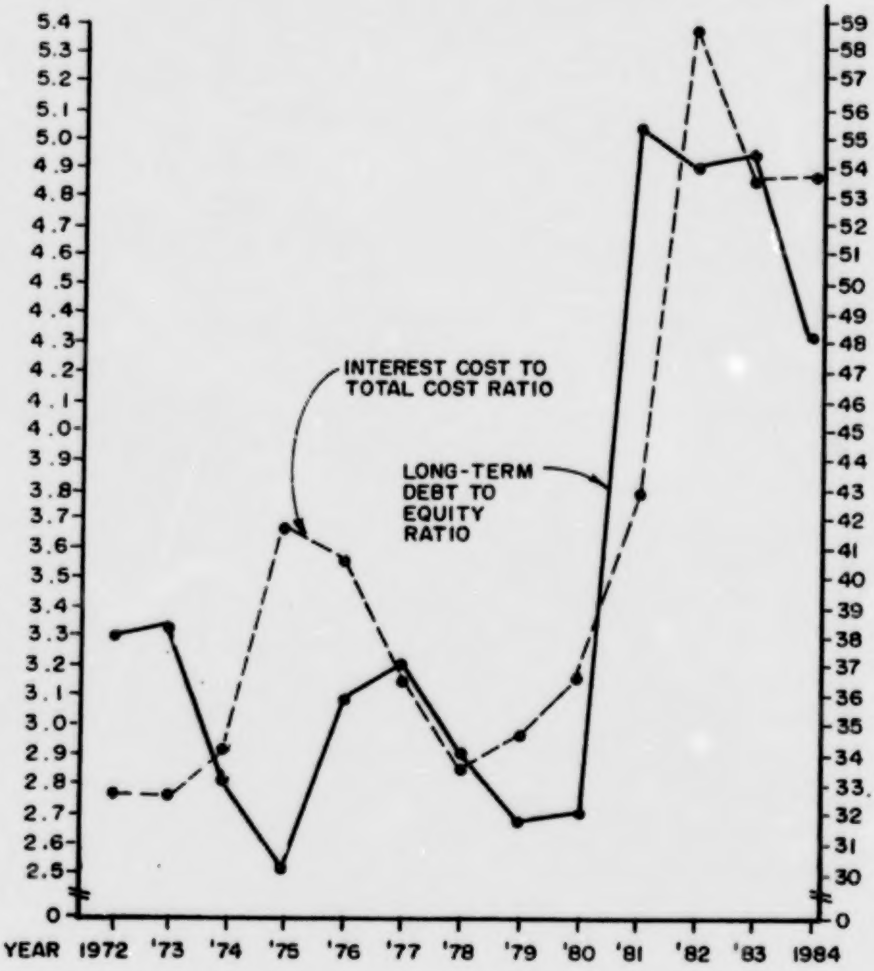
2 Profit after tax on equity ratio is calculated as follows:

$$\frac{\text{Net profit after taxes}}{\text{All non-current debt, remuneration or mortgages, due to shareholders or affiliated corporations, plus total equity}} \text{ X } 100\%$$

Source: Statistics Canada Catalogue 61:207

FIGURE 1:3

LONG-TERM DEBT TO EQUITY[1] (RIGHT AXIS) AND
INTEREST COST TO TOTAL COST[2] (LEFT AXIS)
IN THE CANADIAN PULP AND PAPER INDUSTRY
1972 - 1984



1 Long-term debt to equity ratio is calculated as follows:
$\frac{\text{Net long-term debt}}{\text{All non-current debt, remuneration or mortgages, due to shareholders or affiliated corporations, plus total equity}} \times 100\%$

2 Interest cost to total cost ratio is calculated as follows:
$\frac{\text{Interest expense}}{\text{Total expense}} \times 100\%$

Source: Statistics Canada Catalogue 61:207

period 1972 to 1984. Cyclical fluctuations within the industry, like all other industries, is due in large measure to the business cycle. Demand for paper products is high when economic conditions are good, and low when economic conditions are poor. However, the high peaks and troughs also can be explained in terms of the difficulty the industry has in liquidating its capital assets. This not only retards the ease of firm exit and entry, but exacerbates the ups and downs in the industry.

The collective response of individual mills at both ends of the business cycle accentuate peaks and troughs within the industry. The historical pattern is for individual mills to increase production capacity in response to increases in demand and higher prices. New manufacturing lines are introduced into the industry as it approaches full capacity. The inevitable downturn is made more serious as a result of the capacity introduced during the previous upswing. During periods of low demand, price discounting to maintain production and avoid temporary shutdowns, prevents the market from clearing so prices remain low for a longer period than would be the case if production cutbacks were to bring supply more quickly into line with lulls in demand.

Historical Development

The significance of the industry as a contributor to a distinctly Canadian mosaic is revealed most clearly by the fact that it is not only one of Canada's oldest industries, but one in which residents of Canada (or what was to become Canada) have distinguished themselves as innovators. The first paper mill in Lower Canada was established in St. Andrews in 1803. The first mill to commence operation in Upper Canada was built in 1813 near Hamilton. The maritime provinces entered the industry in 1819, when a mill located near Halifax commenced operation. By 1851, Upper and Lower Canada together had a total of ten mills.[9]

During the period up to Confederation, the industry produced nearly all of its paper from rags. In fact the first mill in British Columbia, built in 1894, produced pulp from rags imported from Great Britain. Charles Fenerty, a Nova Scotian, is credited with being the first to make a sheet of paper from wood, and to use grindstone for reducing wood to pulp in 1841.[10] The first dam built on a river to produce electrical power was for a paper mill located at Credit River in 1858.[11] The first pulp mill in Canada to produce pulp from wood using the soda process was built at Windsor Mills, Quebec, in 1864.[12] A few years later, what is claimed to be the first wood grinder in America began manufacturing wood pulp by mechanical process at a mill located in Valleyfield, Quebec in 1866.[13] The first sulphite mill in North America was built in Northern Ontario in 1885.[14] The hemisphere's first kraft mill was built in Quebec in 1907.[15]

With the successful introduction of wood pulp processing, the pulp and paper manufacturing in Canada began to flourish. Canada with its abundant forests, and extensive water resources was ideally suited for this type of production. As shown in Table 1:10, by 1871 Canada had 21 mills in operation. These mills had 760 employees for an average employment per mill of 36.2. Ten years later, Canada had 41 mills employing 1,588 workers with average employment per mill of 38.7. As revealed in this Table, the industry showed rapid growth both in production facilities (capacity) and in employment to 1891. At the beginning of the century Canada had 53 mills, which employed 6,236 workers for average level of employment per mill of about 118. Despite this rapid growth however, the mills were often tied to newspaper outlets in Quebec and Ontario, and the industry itself served mainly a small domestic market.

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[9] Pulp and Paper Facts and Figures, Canadian Pulp and Paper Association, Sun Life Building, Montreal, March 1946, p.4.

[10] George Carruthers, Paper Making In Canada, Part I and II, the Garden City Press Corporation, Toronto, 1947, p.696.

[11] Nathan Reich, National Problems of Canada: The Pulp and Paper Industry in Canada, Department of Economics and Political Science, McGill University, St. Martin's House, Toronto, 1926, p.15.

[12] Loc. cit.

[13] The Pulp and Paper Industry 1928-1929, Dominion Bureau of Statistics, Census of Industry, Forest Products Branch, 1930, p.7.

[14] Joint Textbook Committee of the Paper Industry, Pulp and Paper Manufacture, The Pulping of Wood, Vol. I, McGraw-Hill, 2nd edit., 1969, p.278.

[15] Ibid., p.350.

In the United States during this period the demand for paper (mainly newsprint) had been growing steadily. Canada in response to this had been exporting an increasing amount of pulpwood to meet this growing demand and to offset the depleting forestry reserves in the northeastern states. As a result, there was growing resentment in Canada about the export of raw wood resources.[16] This resentment together with the concern in the United States over its declining wood supply caused governments to enact legislation that had a dramatic effect on Canada's pulp and paper industry.

The first of these government actions was in Ontario where they passed legislation to prevent the export of pulpwood cut on Crown owned lands in 1900; the Federal Government passed similar legislation covering the Prairie provinces in 1907. This was followed by legislation prohibit-

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[16] Dominion Bureau of Statistics, op. cit., p.8.

Table 1:10

NUMBER[1] OF PULP AND PAPER MILLS IN CANADA, TOTAL AND AVERAGE EMPLOYMENT FOR SELECTED YEARS DURING PERIOD 1871 TO 1985

Year	# Mills	# Employees	Average Employment Per Mill
1871	21	760	36.2
1881	41	1,588	38.7
1891	58	2,817	48.6
1901	53	6,236	117.7
1911	72	9,766	135.6
1921	100	24,619	246.2
1931	103	26,669	258.9
1941	106	37,154	350.5
1951	126	57,291	454.7
1961	125	65,799	526.4
1971[2]	142	79,397	559.1
1981	144	87,882	610.3
1983	137	79,164	577.8
1984	142	79,404	559.2
1985	137	77,562	566.1

[1] The information presented in this Table on the number of mills in the industry is based on data reported by the CPPA. These data do not coincide with information presented elsewhere in this report or with similar information gathered by Statistics Canada. These slight discrepancies are due to definitional variations that result directly from differing perspectives of the industry (see Appendix I).

[2] Woods Employees not included in 1971 and subsequent years.

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

ing the export of pulpwood in Quebec, New Brunswick, and in British Columbia, in 1910, 1911, and 1913, respectively.[17] The United States, in an attempt to relieve the problems associated with reduced wood supply and growing domestic paper demand, revised their tariffs in 1909, 1911, and 1913 to allow greater access to their large domestic market.[18] Canada with its substantial resource endowments had a comparative advantage over its competitors for producing pulp and paper. This competitive advantage became even more pronounced when the Canadian government prohibited the export of pulpwood. With the embargo on pulpwood exports, a few new Canadian plants were built and some United States producers transferred their manufacturing operations into Canada.[19] The lowering and eventual elimination of tariffs on newsprint entering the United States, although only a natural manifestation of a situation that had arisen over many years, nonetheless provided the final impetus for a very rapid sustained rate of growth that took place after the initial growth period up to 1891. During the period 1901 to 1921 the export of Canadian produced pulp and paper, mainly to the United States, established the industry as a major earner of foreign exchange.

The information contained in Table 1:10 shows that between 1901 and 1921 the number of mills in the industry nearly doubled. The phenominal rate at which the industry grew becomes even more evident, when it is realised that the total value of the output of the pulp and paper went from roughly $8 million at the beginning of the century to $150 million in the years immediately following World War I.[20] The competitive strength of Canadian produced pulp grew in international markets after 1935, as a result of the work of a Canadian, G.H. Tomlinson, which rendered the more sought after kraft pulp cheaper to produce.[21] By 1921, the industry had established itself at the top of the list of manufacturers producing the highest gross value of production.[22] At the outbreak of World War II, the industry had grown to 106 mills with the total value of production that exceeded $300 million. As a result of the War, paper and paperboard production almost doubled. The industry contributed to the war effort by producing nitro cellulose for explosives, rayon for parachutes, and paper boxes to replace the much needed wooden crates for the transportation of urgently required military supplies.[23] In its laboratories, the industry conducted confidential and effective experiments that related to the war effort.[24] By the end of the Second World War, the industry had solidified Canada's place as one of the world's leading manufacturers of pulp and paper.

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[17] Loc. cit.
[18] CPPA, op. cit., p.6.
[19] Reich, op. cit., p.18.
[20] Dominion Bureau of Statistics, op. cit., p.7.

Current Stage of Development

During World War II, the industry had lost its place as Canada's leading manufacturer to the war industries (i.e. shipbuilding, chemicals, iron, steel). This soon changed immediately following the War when pulp and paper manufacturing once again assumed its traditional role as the nation's leading industry in terms of both value of production and total employment.[25] To a considerable extent, the importance of the industry was maintained because of the imagination, skills, and energies of those who worked in the industry. The collective willingness of the industry to be innovative and adopt new approaches resulted in continual improvements in both products and productivity. During more recent times, the importance of this type of innovation in international markets is revealed most clearly by the improvements in bleaching methods that are attributed to a Canadian, W.H. Rapson, which has opened up new markets for Canadian produced pulp.[26]

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[21] CPPA, From Watershed to Watermark, January 1980, p.18.

[22] Reich, op. cit., p.19.

[23] CPPA, op. cit., p.7.

[24] Ibid., p.8 One example of such clandestine activities was recalled by William Stevenson in: William Stevenson, A Man Called Intrepid: The Secret War, Ballentine Books, New York, 1977, p.294.

The successes subsequent to WWII, however, do not match the advancements that took place during the earlier part of the century. For example, during the period from the end of World War II to the present, the pulp and paper industry's contribution to gross national product has decreased from more than five percent to slightly less than three percent (Table 1:1). The industry's contribution to total domestic exports has declined from almost 23 percent to over eight percent (Table 1:2). Its world share of wood pulp production has dropped from 22 percent to fifteen percent, and from 55 to 32 percent in newsprint production (Table 1:3). Most of Canada's harvestable timber has been committed to existing operations in the forest products industry, and a substantial amount of what was previously forest land has been alienated into other uses.[27] As well, there are the problems with excessive harvesting, and the claim by some that reforestation programs have been inadequate to sustain present levels of output.[28] Competition for the use of water resources means that water is no longer as freely available as in the past.[29] These generally less attractive indicators, together, suggest that the pulp and paper industry has reached a level of maturity whereby the rapid rates of growth experienced in the past, are no longer possible.

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[25] Reference Tables, Canadian Pulp and Paper Association, 1951.

[26] W. Howard Rapson, "A New Process for the Manufacture of Chlorine Dioxide", TAPPI, Vol. 41, No. 4, April 1958.

[27] F.L.C. Reed, Forest Management In Canada, Forest Management Information Report FMR-X-102, January 1968, p.139. Canada's Threatened Forests, Science Council of Canada, Ottawa, March 1983.

The observation that the industry has reached a level of maturity that precludes future rates of growth similar to those experienced in the past, does not necessarily mean that it is on a decline. The changes in overall contribution to the economy, which have taken place over time, are the result of relative rather than absolute changes. During the past three decades, the output of the Canadian economy has grown at a substantial rate, its commercial activities have become increasingly diversified, and as a result, the level of dependence on any particular industry has been reduced. This is true of pulp and paper manufacturing just as it is true of agriculture, mining, and other Canadian industries. As previously noted, the pulp and paper industry continues to lead all other Canadian manufacturers in the value of production. However, its future as the leader over other industries as Canada's most important manufacturer is sometimes brought into question.

Future Potential of the Pulp and Paper Industry

In a country where the sale of domestically produced goods in international markets is the life blood of the economy, it follows that the future overall importance of the industry to Canadians depends on how well the industry continues to perform internationally. This in turn, will ultimately be determined by the long-run competitive strength of the Canadian pulp and paper industry in world markets. The long-run market strength of an industry depends on the effective demand for products that the industry produces. The demand for any product depends on a number of complex relationships that are extremely difficult to assess.[30] The historical development of the Canadian pulp and paper industry suggests that the industry's ability to compete in international markets, depends most critically on three main factors. These include: (1) the continued access to a readily available supply of good quality pulpwood, (2) the economic efficiency of mills located in Canada, and (3) the vulnerability of demand for Canadian produced pulp and paper to shifts in economic conditions in world markets.

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[28] Response to Challenges and Choices: The Interim Report of the Royal Commission on the Economic Union and Development Prospects in Canada, Canadian Pulp and Paper Association, Montreal, October 1984, p.27.

[29] P.H. Pearse, F. Bertrand, J.W. MacLaren, Currents of Change, Final Report Inquiry on Federal Water Policy, Ottawa, September 1985, p.47.

Even a very cursory examination of the pulp and paper industry, reveals a very substantial degree of dependence on a readily available good quality wood supply. In fact, much of Canada's early success as a pulp and paper producing nation was the result of its vast forestry base. It could be argued that, what some economists claim as the all important "take-off" stage of growth necessary to sustain long-term economic success, was provided by a fortunate set of circumstances that allowed Canada to use its vast forestry base and abundant water reserves to take advantage of the opportunities offered by the introduction of wood pulping processing techniques.[31] Nonetheless, the key factor which supported the industry through the various stages of development was the large and readily accessible timber supply. However, as noted above, the industry may not continue to have ready access to good quality pulpwood in future. If this is indeed the case, future wood supply shortages may detrimentally effect the competitiveness of Canadian producers in world markets.

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[30] In fact, most demand forecasts involve intricate analyses, which go well beyond the scope of this paper.

[31] W.W. Rostow, The Stages of Economic Growth, 2nd ed., Cambridge University Press, New York, 1971.

Once again, however, the competitiveness of Canadian producers in world markets depends on relative changes and not on the direction or absolute size of the changes. The forest base in Canada remains both rich and abundant when compared to other forestry nations of the world.[32] Softwood species are the preferred fiber source for the production of paper. According to the Food and Agriculture Organisation (FAO), Canada has about ten percent of the world's forest areas, about 6.5 percent of the world's growing forest stock, and accounts for roughly thirteen percent of the world's softwood production. Even though many argue that Canada's timber reserve has declined due to poor management practices, the same also is true of other forest nations. The increased effort that is being made by the industry and government to correct the problems associated with past excesses through more intensive forest management, bodes well for the future. The costs of harvesting, especially in the undeveloped Canadian forest regions, will increase. This unto itself does not necessarily imply that the competitive position of Canada is assured. Nonetheless, Canada with its very substantial land base is not facing the strong competition for alternative uses in its forest land, as is the case among competitor nations with their much larger populations. If the corrective measures that are now underway to protect and enhance Canada's forest base are moderately successful, it can be expected that the Canadian pulp and paper industry's present position in world markets will not be jeopardised because of insufficient wood supplies.

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[32] R.M. Newnham, Forest Management In Canada, Forest Management Institute Information Report FMR-X-104, F.L.C. Reed & Associates, Ottawa, January 1987, pp.24-30. Selected Forestry Statistics, Economics Branch, Canadian Forestry Service, Ottawa, April 1986, pp.140-150.

The competitive position of Canada's pulp and paper industry, like other Canadian industries, is determined by the productivity and cost performance of Canadian producers relative to its competitors. In this regard, a major consideration is the "state of art" of the technology employed. Those who have voiced concern over Canada's ability to compete in world markets most often cite the old plants and out-of-date equipment utilised in the industry, particularly, in the eastern provinces.[33] The obvious reason for this concern is revealed most conveniently by comparing the age and capacity of the industry's newsprint machines with that of other countries.

The information presented in Table 1:11 shows the age distribution of the newsprint machines operating in Canada, the United States, and Scandinavian countries during 1983. According to this information, 58 percent of the newsprint machines operating in Canada during 1983 commenced operation prior to 1950. This compares with 28 percent in the United States and seven percent in Scandinavia. In other words, 42 percent of Canada's newsprint machines commenced operation subsequent to 1950. Once again, this compares with 72 percent in the United States and 93 percent

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[33] Peter A. Victor et al., Environmental Protection Regulations: Water Pollution, and the Pulp and Paper Industry, Technical Report Series, Technical Report No. 14, Economic Council of Canada, Ottawa, August 1981, p.3.

TABLE 1:11

AGE DISTRIBUTION OF NEWSPRINT MACHINES OPERATING IN CANADA, UNITED STATES, AND SCANDINAVIAN COUNTRIES - 1983

Period New or Reconditioned Machines Commenced Operation	Canada %	United States %	Scandinavian Countries %
Prior to 1950	58	28	7
1950 to 1970	19	45	50
After 1970	23	27	43

Source: DRIE, The Canadian Forest Products Industries: An Assessment of the Pulp and Paper Industry, March 12 1984.

in the Scandinavian countries. This information clearly shows that during 1983, the newsprint machines operating in Canada were of older vintage than those in either the United States or Scandinavia.

The distribution of production capacity for newsprint machines in Canada, the United States, Sweden, Finland, and Norway for 1983 is presented in Table 1:12. The information presented in this Table shows that 50 percent of Canada's newsprint machines have an annual production capacity of less than 100,000 tonnes. In the United States, fifteen percent have a capacity of less than 100,000 tonnes per year, while zero percent in Sweden, 30 percent in Finland, and 40 percent in Norway have similar capacity. Conversely, 50 percent of the newsprint machines in Scandinavia have an annual production capacity of greater than 100,000 tonnes. This compares with 30 percent in the United States, 80 percent in Sweden, 40 percent in Finland, twenty percent in Norway, and fifteen percent of the machines in Canada which have similar capacity. Once again, these data suggest that for the year 1983, the newsprint production capabilities probably were less efficient in Canada than either the United States, Sweden, Finland, and Norway.[34]

While the rather pessimistic perspective projected by those data presented in Tables 1:11 and 1:12 probably provide a generally accurate picture of the state of technology used in the industry through the early 1980's, the general direction of trends within the industry give reason for optimism about the future.[35] For example, the level of technology

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[34] The use of older and smaller newsprint machines likely would effect wood utilisation and pulp processing efficiencies. They also use more energy and are less conducive to environmental control.

[35] The Market Pulp Industry 1983-1986, Forest Sector Advisory Council, October 1987.

TABLE 1:12

ANNUAL PRODUCTION CAPACITY OF CANADIAN, UNITED STATES AND SCANDINAVIAN NEWSPRINT MACHINES - 1983
(IN 000's TONNES PER YEAR)

Capacity of Operating Newsprint Machines	Canada %	United States %	Sweden %	Finland %	Norway %
Less than 100 tonnes per year	50	15	0	30	40
100 to 150 tonnes per year	35	55	20	30	40
Over 150 tonnes per year	15	30	80	40	20

Source: DRIE, The Canadian Forest Products Industries: An Assessment of the Pulp and Paper Industry, March 12 1984.

used within the industry would be at least partially revealed by a comparison of the end of the year annual capital stock accumulation with yearly changes in output of final product. This information is presented in Tables 1:13 and 1:14. Table 1:13 is used to show the value of capital stock each year to the physical output of final processed product produced for the period 1960 to 1985. The annual production ratios are presented for newsprint, other papers, and chemical pulp for the same period. The information presented in this Table indicates that the ratic of the value of capital stock utilised within the industry per tonne of production increased at a very slow rate over the 1968 to 1973. It increased in 1975, but grew slowly or not at all during most of the 1970's. The capital output ratio declines in 1978 and in 1980 preceded the subsequent recession in the early 1980's. The percentage of actual production to production capacity, although fluctuating a fair amount in both the paper and pulping sections of the industry, suggests that changes in the capital stock output ratio was not significantly influenced by use capacity levels during any part of the 25 year period shown on the Table. Further, it shows that the value of capital employed in the industry has been steadily increasing. Overall, it would appear that the industry is capable of tightening its belt when economic circumstances necessitate the more efficient utilisation of existing production facilities.

Table 1:14 is used to show the gross pulp and paper production and end of year capital stock accumulation for the industry over the period 1971 to 1985. According to this information, Canada's gross pulp and paper production (including pulp used as an intermediary input)

TABLE 1:13

VALUE OF CAPITAL STOCK TO TOTAL FINAL PROCESSED PRODUCT PRODUCTION AND PRODUCTION RATIOS FOR PULP AND PAPER INDUSTRY IN CANADA 1960 - 1985

	Gross Capital Stock (Constant 1971 $'000's)	Production[1] (000's tonnes)	Ratio (Capital $0'000 to 1,000) (tonnes of Production)	Production Ratios[2]		
				Newsprint	Other Paper	Chemical Pulp
1960	4,055,505	7,754	523:1	89	-	87
1963	4,477,201	7,998	560:1	82	-	85
1965	5,227,524	9,259	565:1	92	95	95
1968	6,424,116	9,988	643:1	83	84	85
1970	7,031,656	10,953	642:1	90	89	87
1973	7,824,721	12,132	645.1	88	91	90
1975	8,143,292	10,525	774:1	76	62	67
1978	8,556,540	13,205	648:1	98	97	89
1980	8,980,408	13,347	673:1	94	88	95
1983	10,156,124	13,089	776:1	85	88	86
1985	10,527,734	14,543	724:1	92	97	87

[1] Final processed production includes newsprint, book and writing paper, tissues, sanitary papers, building paper, board and wrapping paper, cartons, and does not include pulp.

[2] These ratios are calculated as percentage of actual production to production capacity.

Source: Canadian Pulp and Paper Association, and Statistics Canada, end of year gross stock data: Catalogue 15211.

TABLE 1:14

GROSS PULP AND PAPER PRODUCTION[1] AND END OF YEAR CAPITAL STOCK OVER FOURTEEN YEAR PERIOD 1971 TO 1985

Year	Gross Pulp & Paper Annual Production (000's) tonnes	End of Year Gross Capital Stock Constant 1971 Dollars (000's)
1971	27,703	7,427,494
1976	29,737	8,371,600
1981	34,528	9,593,285
1983	33,876	10,156,124
1985*	35,343	10,527,734
% Change 1971 to 1985	27.6	41.7

* Preliminary estimate

[1] Does not include building board production, but does include pulp produced as an intermediary input within integrated operations to produce paper. Intermediary pulp production is included because it does represent production which can be sold in the market. However, intermediary pulp production also is included in final paper production and results in double counting. Therefore, the use of these figures to estimate value of production would overestimate the total value of production within the industry. The gross production estimates presented here reflects total physical production of pulp and paper products (excluding building board production) with market value. As such, this information is considered suitable for examining gross production trends within the industry.

Source: Canadian Pulp and Paper Association and Statistics Canada.

increased by 27.6 percent while the end of the year gross capital stock in the industry increased by 41.7 percent during the fourteen year period ending in 1985. Clearly, this information shows a more rapid rate of accumulation of capital stock within the industry than increase in production.

When the data presented in Table 1:14 are compared with data from other sources, the prospects for the future of the industry appear good. In this regard, it has been projected that the level of investment in the industry over the period 1985 to 1991 will be between \$4 and \$6 billion.[36] Even if the total capital investment that actually takes place within the industry falls short of the projected high of \$6 billion, a commitment of that magnitude has to be viewed as a very substantial effort to upgrade existing production facilities. As noted above, most of Canada's existing forest land has already been committed, therefore, it can be anticipated that a very substantial portion of new capital investment will be devoted to improving production facilities rather than merely expanding on the total volume of product produced. The obvious implication of this is that new investment initiatives within the industry, such as those envisioned to 1991, will result in positive improvements in the state of technology utilised.

Although the state of technology has a direct and very visible effect on the productivity of an industry, technology is not the only or necessarily most important consideration when assessing an industry's future competitiveness. Essential in this regard are the costs of factor inputs relative to the market value of the output of the final product produced. The factor costs that usually have the greatest significance are the: (i) price paid for the raw material utilised (pulpwood), (ii) capital expenses (building and equipment) used for processing, and (iii) the wages and salaries paid to employees. When each of these items is measured against the total value of the output generated over time, it provides a good indication of the direction of changes in production efficiency within the industry.

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[36] John Mullinder, "Industry to Spend \$1.3 Billion This Year, \$4.3 Billion by 1991", Pulp and Paper Journal, Vol. 40, No. 5, May/June 1987, pp.48-65.

Table 1:15 is used to show the market value of production (output) to the value of capital stock, human resources, and pulpwood utilised within the Canadian pulp and paper industry over the period 1960 to 1984. The data presented in this Table confirms, what was already noted above, that the value of capital stock used has increased faster than the output of the industry for many years. However, these data also show that during the period 1960 to 1984, the market value of production to pulpwood used in processing has remained relatively stable. The ratio of the value of output to the cost of management and labour employed has risen dramatically. The market value of gross production has increased by 105 percent, the gross capital stock of the industry has risen 154 percent, the cost of management and labour employed in the industry has declined by 69 percent, and the value of production has gone up by 81 percent. The data contained in Table 1:15 indicates that the cost performance of the industry has been reasonably good over the 24 year period ending in 1984.

TABLE 1:15

MARKET VALUE OF PRODUCTION/OUTPUT AS A PERCENTAGE OF CAPITAL EMPLOYED AND AS A RATIO OF THE COST OF MANAGEMENT AND LABOUR UTILIZED IN THE INDUSTRY

1960 - 1984

Year	Market Value of Gross Production/ Output in Industry[1] (Constant 1971 $'000)	End of Year Gross Capital Stock Used in Industry (Constant 1971 $'000)	Cost of Management and Labour Employed[2] in Industry (Constant 1971 $'000)	Cost (Value) of Pulp Wood Consumed in Industry[3] (Constant 1971 $'000)	Market Value of Output as % of Value of Capital Employed	Ratio of Value of Output to Cost of Management and Labour Employed	Ratio of Value of Output to Cost of Pulp Wood Consumed in Industry
1960	1,871,158	4,055,505	88,522	571,148	46.1	21.1	3.3
1963	2,051,546	4,477,201	84,260	575,858	45.8	24.4	3.6
1965	2,369,663	5,227,524	86,829	643,768	45.3	27.3	3.7
1968	2,601,063	6,424,116	81,664	702,492	40.4	31.8	3.7
1970	2,867,735	7,031,656	82,686	805,349	40.8	34.7	3.6
1973	3,367,529	7,824,721	71,060	645,059	43.0	47.4	5.2
1975	2,891,816	8,143,292	60,683	855,628	35.5	47.7	3.4
1978	3,700,784	8,556,540	48,859	869,569	43.3	75.7	4.3
1980	3,965,007	8,980,408	41,250	997,599	44.2	96.1	4.0
1983	3,606,248	10,156,124	28,507	992,511	35.5	126.5	3.6
1984	3,841,781	10,304,420	27,399	1,034,738	37.3	140.2	3.7
% Change 1960 - 1984	+105	+154	-69	+81			

[1] Value of output is adjusted to 1971 dollars using average annual industry selling price index for paper and allied industries.

[2] Cost of labour employed is adjusted to 1971 dollars (or real wages) using average annual Consumer Price Index.

[3] Cost of pulp wood consumed is adjusted to 1971 dollars using average annual price index for lumber and timber 1960-1976 inclusively and a raw materials price index for pulp wood 1977 to 1984.

Source: Statistics Canada and Canadian Pulp and Paper Association.

When it is recognised that in the not too distant past, it was generally conceded that there was a critical need for modernisation among pulp and paper manufacturers in Canada, the overall implications of the information presented in Tables 1:13, 1:14 and 1:15 suggests that the industry has made very significant progress in improving the capital stock of the industry.[37] The industry has become more efficient in terms of the human resources utilised. Despite periods of high inflation in the late 1970's and earliest part of the 1980's, the industry has been able to control the cost of its raw material inputs. It does not appear to be the profile of an industry on the demise, but rather, one that has put itself in a position for strong economic performance in future.

When examining the vulnerability of demand for Canadian produced pulp and paper, it should be recognised that roughly 75 percent of pulp and paper industry's gross production is sold in international markets (see Table 1:4). It also should be recognised that a key element in maintaining the importance of the industry in Canada has been the unrestrained access to the United States domestic market which the industry has enjoyed for more than 70 years, particularly with respect to newsprint production. The Canadian industry has accounted for more than one-fifth of the total United States domestic market since as early as 1915 (see Table 1:16). In fact, it could be argued that the income and standard of living of every Canadian is at least partially dependent on the ongoing sale of domestically produced pulp and paper in the United

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[37] As a result of this need, the Federal Government entered into a series of cost-sharing arrangements with the provinces in 1979 to establish a "Modernisation Program" to accelerate private sector investment in the industry. British Columbia and the prairie provinces chose not to participate in the modernisation program.

TABLE 1:16

CANADIAN PRODUCED NEWSPRINT
EXPORTED SHARE OF U.S.A.
DOMESTIC MARKET
1915 to 1985

Year	Canadian Exports of Newsprint to the U.S.A. ('000 tonnes)	U.S.A. Domestic Consumption of Newsprint ('000 tonnes)	Canadian Exports of Newsprint as a % of U.S.A. Domestic Consumption
1915	300	1,370	21.9
1920	615	1,995	30.8
1930	1,945	3,265	59.6
1940	2,485	3,385	73.4
1950	4,307	5,380	80.1
1960	4,789	6,694	71.5
1970	5,242	8,884	59.0
1980	6,118	10,300	59.4
1983	6,034	10,589	57.0
1985*	6,668	11,587	57.6

* Preliminary estimate

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

States domestic market. Unfortunately, the growth and diversification that has taken place within the industry over the past several decades has done little to diminish the dependence on this single market.

The overwhelming reliance on this single market is revealed by the information presented in Table 1:17. According to the information presented in this Table, only four percent of Canada's total pulp exports, and 8.7 percent of its newsprint exports are sold in countries other than the United States. This very substantial dependence on a single market indicates a high degree of vulnerability to the circumstances of that market. It suggests that the long-term economic stability within the industry depends directly on the maintenance of effective demand for pulp and paper products in the United States.[38] Further, it indicates that the future of the industry as Canada's number one manufacturer ultimately may depend on the relative level of reliance that the Canadian pulp and paper manufacturing has on the United States market when compared with other Canadian industry.

The demand for pulp and paper in North American markets rises and falls with fluctuations in the general economy. During periods when the economy is buoyant and expectations are high, the demand for paper is high as well. When the economy is flat and expectations are low, the demand for paper also is low. It is for this reason that it is a cyclical industry where the bad times are followed by good times and vice versa. The profits made during periods of high sales and good returns often have to be used to offset the losses when sales are poor and returns are

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[38] W.T. Easterbrook and Hugh G.J. Aitken, Canadian Economic History, McMillan Company, Toronto, 1965, p.546.

TABLE 1:17

CANADIAN PULP AND PAPER INDUSTRY EXPORTS OF WOOD PULP AND NEWSPRINT AS A SHARE OF WORLD CONSUMPTION EXCLUDING U.S.A. DOMESTIC CONSUMPTION

1950 to 1984
('000 tonnes)

	WOOD PULP			NEWSPRINT		
Year	Canadian Exports Excluding U.S.A.	World Apparent Consumption Excluding U.S.A.	Canadian Exports as Percent of World Consumption Excluding U.S.A.	Canadian Exports Excluding U.S.A.	World Consumption Excluding U.S.A.	Canadian Exports as Percent of World Consumption Excluding U.S.A.
1950	138	19,261	.71	189	3,373	5.60
1960	546	35,974	1.52	895	6,976	12.83
1970	2,055	64,640	3.18	1,551	12,410	12.50
1980	3,732	81,265	4.59	1,524	14,915	10.22
1982	3,012	76,427	3.94	1,525	15,007	10.16
1983	3,436	80,521	4.27	1,436	14,728	9.75
1984	3,435	84,556	4.06	1,363	15,685*	8.69

* Preliminary estimate

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

down.[39] The demand for pulp and paper in the United States is very sensitive to their domestic market conditions. However, sensitivity to demand does not necessarily mean that the pulp and paper industry is more dependent on the United States market than other Canadian manufacturers. For example as shown in Table 1:18, total exports to the United States as a percentage of total domestic exports has risen from 70.8 percent in 1969 to 78.5 percent in 1985. According to the information presented in Table 1:17, Canadian exports of wood pulp as a percentage of world consumption in nations other than the United States also has risen. However, Canadian exports of newsprint to other countries has decreased. Overall, the total of this information reveals that total Canadian export production has become more dependent, while pulp and paper export production has remained about the same or declined.

Table 1:19 is used to show the Canadian share of apparent United States domestic consumption of wood pulp for period 1940 to 1985. This information is comparable to the information presented in Table 1:16 which shows the Canadian export share of the newsprint domestic market in the United States for the period 1915 to 1985. According to the information in these two Tables, the importance of Canadian produced newsprint in the United States domestic market increased continuously from 1915 to 1950. In 1950, it accounted for 80.1 percent of the total United States' domestic consumption. While it remained a very significant portion of

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[39] The very substantial importance of the pulp and paper industry in Canada and the heavy reliance of this industry on the United States domestic market, together, help to explain why the business cycles in Canada tend to follow similar cycles in the United States with a fairly consistent time lag. It also helps to explain why the standard of living of Canadians is almost inextricably tied to economic conditions in the United States.

TABLE 1:18

VALUE OF TOTAL EXPORTS TO USA, AS A PERCENTAGE OF TOTAL CANADIAN EXPORTS: VALUE OF PULP AND PAPER EXPORTS TO USA AS PERCENTAGE OF TOTAL EXPORTS TO USA FOR SELECTED YEARS 1969 TO 1985

Year	Total Domestic Exports ($'000) (1)	Total Exports to USA ($'000) (2)	Pulp and Paper Exports to USA ($'000) (3)	Total Exports to USA as % to Total Domestic Exports (2 of 1) (4)	Pulp and Paper Exports to USA as % of Total Exports to USA (3 of 2) (5)
1969	14,503,638	10,273,650	1,502,043	70.8	14.6
1971	17,575,386	11,681,556	1,440,410	66.5	12.3
1973	24,719,157	16,611,868	1,824,883	67.2	11.0
1975	32,325,043	21,044,119	2,486,023	65.1	11.8
1977	43,565,799	30,435,811	3,353,134	69.9	11.0
1979	64,190,327	43,463,376	4,770,421	67.7	11.0
1981	81,336,731	53,899,776	5,826,937	66.2	10.8
1983	90,963,910	66,332,528	5,640,655	72.9	8.5
1985*	120,258,000	94,346,000	7,575,000	78.5	8.0

* Preliminary estimate

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

TABLE 1:19

CANADIAN PRODUCED WOOD PULP
EXPORTED SHARE OF APPARENT U.S.A.
DOMESTIC MARKET
1940 to 1985

Year	Canadian Exports of Wood Pulp to the U.S.A. ('000 tonnes)	U.S.A. Domestic Consumption of Wood Pulp ('000 tonnes)	Canadian Exports to U.S.A. as a % of Apparent Domestic Consumption
1940	900	8,873	10.1
1950	1,537	15,547	9.9
1960	1,814	24,091	7.5
1970	3,008	39,863	7.5
1980	3,516	49,002	7.2
1983	3,387	48,091	7.0
1985*	3,551	51,252	6.9

* Preliminary estimate

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistical Report on Industry.

that market in 1985, its overall share of the market has declined since 1950. The information presented in Table 1:19, shows that the Canadian share of the United States domestic market for wood pulp has continuously declined over the period 1940 to 1985. On the basis of the information provided in Tables 1:16, 1:17, 1:18, and 1:19 it does not appear as if the pulp and paper industry has any greater dependence on the United States market than most other large Canadian industries. Further, the very large segment of the domestic newsprint market that the industry has serviced, over a very substantial period of time, suggests that the United States may be as dependent on Canadian manufactured newsprint to serve their domestic market as the industry is dependent on the United States for its sales. Obviously, trade in these commodities has been of mutual benefit to both countries for a very long time, and there is little reason to expect that this will abruptly change within the foreseeable future.

The importance of the United States market to the long-run success of the industry is substantial. However, analyses based on market share can be misleading. The Canadian pulp and paper industry sells pulp and paper products worldwide. These markets have grown over time and in some cases represent a substantial, if not a very large share of total export sales.[40] For example, during the period 1950 to 1983, the annual total volume of world wood pulp consumption increased by 37 percent, while Canadian pulp exports increased by 307 percent.[41] Associated with this is the realisation that foreign investors have been showing a great and growing interest in the Canadian pulp and paper industry. Very large international companies such as Fletcher Challenge of New Zealand have recently purchased into the industry in Canada. China has bought processing facilities in British Columbia, and Japan has expressed an interest in establishing a stake in the industry.[42] This international activity does not necessarily guarantee access to foreign domestic markets, nonetheless, it does demonstrate an interest and confidence about the industry's future.

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[40] An example of the significant level of sales to countries other than the United States is revealed in the fact that $828 million worth of pulp and paper was sold to the European Economic Community during 1986 (Source: Statistics Canada). Of that $828 million worth of sales, $340 million was exported to West Germany. See: The Financial Post, Special Report, November 9 1987, p.46.

[41] Reference Tables, Canadian Pulp and Paper Association.

Perhaps the only potential threat to the Canadian pulp and paper industry as it currently exists, is the possibility of the introduction and use of new fiber sources and processes that can be used to produce pulp more efficiently worldwide. Somewhat more than five percent of the worlds total pulp production currently is made from nonwood fibrous materials, such as esparto, flax, abaca, and other types of cottons and grasses.[43] Although the use of these materials is very limited and serve mostly local domestic markets, their importance are increasing as energy costs rise and the foreign currency reserves of some nations become depleted. One such source that is currently being examined in Canada, and has long been touted as a new alternative crop for United States farmers, is from a plant called kenaf. It is a member of the hibiscus family and looks like cotton. It can be grown from seedling to ten feet high within three months and offers the advantages of brightness and strength for the manufacturer of newsprint. According to reports in the popular media, production costs are about 25 percent lower than it is from traditional sources, and the processes used to produce paper are considered less of a threat to the environment.[44] The disadvantages for the Canadian producer are that the kenaf plant grows mostly in warmer temperatures, which may not be suitable or adaptable to the Canadian climate. However, the use of the kenaf plant, as with all other nonwood fibrous materials, is still largely in the experimental stages and may not prove satisfactory as an alternative to wood pulp production in future except at the very small local level (as is the case at present).

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[42] Alan Daniels, "Bid to Hike Japanese Role in Pulp and Paper Mills Hailed", The Vancouver Sun, October 29 1987, p.B4. Jennifer Hunter, "New Zealand Knight Eyes Global Empire", The Globe and Mail, September 14 1987, p.B10. Kimberley Noble, "Noranda to Sell 15% Block of Revamped Forest Unit", The Globe and Mail, March 27 1987, p.B2. Kimberley Noble, "Canfor, Japanese Firm Plan to Spend $635 Million on a Pulp, Paper Venture", The Globe and Mail, December 8 1987, p.B17.

[43] James P. Casey, Pulp and Paper Chemistry and Chemical Technology, 3rd. ed., Vol. 1, John Wiley and Sons, New York, 1980, pp. 554-567.

Potential Environmental Impacts

The presence of a large and vibrant pulp and paper industry is very important to the people of Canada. As already noted, it not only makes a major contribution to the economy, but helps facilitate social and economic growth at both the national and regional levels. Unfortunately, the pulp and paper industry also has the potential to cause major physical harm to the environment, both as a significant user of resources and a major source of pollutants.

The most visible impact that pulp and paper manufacturing (along with the rest of the forest products industry) has on the environment is through its effect on the nation's forests. The same standing forests that are fundamental to the continued existence of the pulp and paper industry are the habitat of wildlife, and part of the natural support system of livestock. These same forests provide hydrogeological balance for the propagation of fish, as well as vegetative cover for fish habitat. The forests also represent a vast outdoor recreational resource for all Canadians. The nation's water resources which are such a vital part of human life on earth are used in large quantities by pulp and paper producers for transportation, temporary storage, and for processing. In some parts of Canada, logs continue to be stored on the ice of lakes during the winter so that they can be transported across water after spring thaw. In fact, river log drives in Quebec remain a resource conflict problem, which also is environmentally disruptive. The industry has the potential to cause substantial, and even devastating, direct physical harm to the ecosystems within certain, often confined, geographic areas.

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[44] "Quebec Mill Aides in Test of New Newsprint Fibre", Pulp and Paper Journal, Maclean Hunter Limited, Toronto, September 1987, p.17. David Baines, "New Fibers Beats Market Crash", The Vancouver Sun, November 13 1987, p.42.

The pollutants discharged from the pulp and paper mills affect both water and air, and to a lesser extent land. In the United States, where the industry is a more minor part of the overall industrial complex than is true in Canada, the pulp and paper industry is considered the nation's third largest polluter.[45] In Canada, it was estimated that the pulp and paper industry is responsible for 50 percent of all the waste dumped into the nation's waters.[46] The industry is the source of seven of seventeen areas of concern in Ontario identified by the Great Lakes Water Quality Board. Although population comparisons should be interpreted with care, it has been estimated that one kraft mill discharges oxygen demanding substances equal to a city with a population in excess of 120,000 people.[47] On the basis of more recently published information, it can be estimated that pulp and paper manufacturing accounts for roughly 5.6 percent of the common air contaminants from known industrial sources.[48]

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[45] Allan M. Springer, Industrial Environmental Control Pulp and Paper Industry, John Wiley and Sons, New York, 1986, p.3.

[46] Parliamentary Hansard, Commons Debates, Government Organisation Act. Jack Davis, October 3 1970, p.2827.

The effluent discharged from pulp and paper mills into water lowers oxygen levels, disseminates non-filterable residues, and adds both known and unknown compounds to receiving waters. These compounds often have an adverse affect on aquatic organisms and fish. If present in sufficient quantities, some of these compounds can have lethal results. As well, there are the more general problems associated with odor, fish-flesh-tainting, acidity, slime growth, thermal effects, foam, scum, and colour.[49] There also is a potential for harm as a result of the inherent production and discharge of persistent organic compounds.[50] The ultimate consequence of all this is that in the absence of deliberate efforts to control or treat waste discharge, the effluent from pulp and paper mills can cause serious problems, which range all the way from innocuous or temporary minor disruptions in the quality of the receiving waters to health hazards requiring immediate remedial measures.

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[47] P.H. Pearse, et al., op. cit., p.55. Norman Bonsor, Neil McCubbin, and John B. Sprague, Stopping Water Pollution At Its Source: Kraft Mill Effluents in Ontario, Report prepared by Expert Committee on Kraft Mill Toxicity for the Technical Advisory Committee, Pulp and Paper Sector of MISA, Ontario Ministry of the Environment, Toronto, April 1988.

[48] Emissions and Trends of Common Air Contaminants in Canada, 1970-1980, Report EPS 7/AP/17, Environment Canada, Ottawa, September 1986.

[49] Basic Technology, op. cit., pp.9-11. Status Report on Abatement of Water Pollution from the Canadian Pulp and Paper Industry (1982), EPS, Environment Canada, EPS 1-PF-1, October 1984.

[50] Mcleay and Associates, op. cit., p.1.

Although considered somewhat less of an environmental problem than effluent discharges, there are a number of significant air contaminant emissions that result from pulp and paper production. These include particulate matter, sulphur dioxide, total reduced sulphur compounds (TRS). The TRS emissions consist of mainly hydrogen sulphide, methyl mercaptan, dimethyl sulphide, and dimethyl disulphide.[51] These TRS compounds are particularly troublesome because of their disagreeable odor and their low odor threshold. Depending on the processes being used, there is as well the potential for emissions of small quantities of chlorine and chlorine dioxide. These compounds cause aesthetic problems and are a potential health risk for those working in mills.

The very significant amount of potential environmental disruption that can result from the pulp and paper industry's widespread operations has been under scrutiny for many years in Canada. The industry with its overwhelming dependence on the continued existence of a healthy forest resource base historically has monitored its use of the forests, modified its harvest operations to accommodate the special circumstances in particular geographic areas, and it has replanted and tended forest lands subsequent to harvest. Canada's industry has reduced its waste discharge through the adoption of more efficient processing techniques, it has monitored and reported its waste discharges in the general public interest, and as part of an industry that operates worldwide, has helped develop technologies that have made pulp and paper manufacturing less threatening to the environment. Much of this has been done independently by the industry in its own self interest and to help the public. A great deal has been done in cooperation with government or at the urging of government regulating agencies.

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[51] Air Pollution Emissions and Control Technology Wood Pulping Industry, Economic and Technical Review Report EPS 3-AP-77-6, Air Pollution Control Directorate, March 1979.

Government and the Industry

In an industry that always has taken a great deal of comfort in standing alone "against world competition without direct government assistance",[52] it is not always appreciated that the government has worked with pulp and paper manufacturers in serving the interests of Canadians since Canada was first established as a nation.

The obvious need for a strong interactive relationship between the pulp and paper industry and government stems from the very significant role the industry plays in Canada's national and regional economies. The industry's substantial contribution to the nation's tax base and its importance as a source of foreign exchange also contributes to the need for this relationship. Of further significance is the role that the provincial governments have with respect to the nation's timber resources. Most of Canada's forest lands are owned and administered by the provinces in the right of their citizens. The provinces not only own the forests, but they allocate the right of harvest through provincially legislated land tenure arrangements, and set stumpage rates. The Federal Government administers federal lands (mostly in the north), controls international trade,[53] and through traditional arrangements,[54] has involvement in insects, disease, and fire protection research. It collects and disseminates national forestry statistics. Therefore, in a general way the relationship between government and industry is one in which the provinces own and administer the forests, the industry harvests the forests, and the Federal Government works with the provinces and industry by undertaking the research necessary to help protect the valuable forestry resources in the overall national interest.

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[52] CPPA, op. cit., p.4. Patrick Darvaut, "M-B Wise to Avoid Government Help", The Province, Vancouver, November 22 1987, p.40. Mathew Horsman, "Paper Plant Subsidy Plans Draw Outcry", The Globe and Mail, October 26 1987, p.B5.

Even though these long established relationships have seldom resulted in any government intervention which directly determines the success or failure of any part or all of the industry, neither have the activities of government been benign. The lowering of tariffs on Canadian produced paper products in the United States unquestionably gave impetus to the rapid development of the newly emerging paper industry in the early 1900's, but as noted above, so did the embargo placed on the export of pulpwood by the provinces.[55] Governments continue to maintain programs designed to protect the forests for the benefit of the forest industry and other users of forest lands. They have set aside vast amounts of land to preserve national amenities (Banff National Park was established twenty years before Alberta became a province in 1905), which helps to protect the integrated use of forest lands for both commercial and recreational purposes. In more recent years, the two levels of government have financed a modernisation program that eased the transition of industry from one that appeared to be in need of upgrading to one which is currently attracting a very substantial amount of private investment.[56] The Federal Government provides the Pulp and Paper Research Institute of Canada with laboratory facilities to undertake industry supported research, which has made a recognised contribution to pulp and paper manufacturing worldwide. The long-term effects of a consistent trade policy coupled with a provincially administered land tenure system has provided industry with a stable business atmosphere that helps to maintain the large-scale investment required for stable growth. In all, it can be argued that the governments in Canada work well with industry, both in terms of protecting the interests of the general public and in facilitating the opportunities to allow the industry to achieve long-term success.

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[53] The government in Britain had enacted legislation to control the trade of Canada's timber before Confederation.

[54] These arrangements date back to 1873, when the antecedent organisation of the Canadian Forestry Service, the federal Department of the Interior was established.

[55] Reich, op. cit., p.18.

The point here is not to suggest that the government has propped up uneconomic mills, or provided the pulp and paper industry with an advantage over its competitors in international markets. There have been far too many mill failures (i.e. approximately ten over the last twenty years)[57] for reasons of uncompetitiveness to accept any suggestion that government support maintains what would otherwise be economically unviable operations in the pulp and paper industry. More to the point of the issues of concern to this discussion is the fact that the federal and provincial governments over many years have actively regulated activities that either directly or indirectly impact on the industry. Some of these efforts have been limiting to industry, while others have contributed in a very substantial way to its success. Those that argue that environmental regulations represent an unnecessary infringement on the ability and rights of the industry to respond to incentives that emanate from the marketplace fail to recognise the traditional role of government in most free enterprise nations throughout the world. They are ignoring that governments in Canada have a well established history of working with the private sector in the general interest. As one of the principal benefactors from raw materials that are produced from a publicly owned resource, the pulp and paper industry has a responsibility to protect environmental integrity.

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[56] Victor, et al., op. cit., p.3.

[57] Canadian Paper Analyst, Victoria Station, Westmount, Quebec, Vol. IX, August 1987, p.6. It often is difficult to determine when mill operators are unable to continue for reasons involving financial difficulty. Some mills close down a single process, others sell to new owners, and still others close down and reopen after refinancing and reconstruction. Sometimes an economically unviable operation is turned around with new owners or after plant renovation. In other cases, the new operators merely purchase a mill to gain access to timber holdings or to increase market share. The high cost of building a new mill frequently makes it more economically desirable to purchase an old plant rather than to build an entirely new facility. All of these factors, together with the increasing concentration within the industry, help to disguise business failures.

Summary

The first paper mill in Canada was established in 1803. Over the next 48 years a series of small facilities were built in both Upper and Lower Canada so that by 1851 there were a total of ten mills. Up until approximately 1840 all of the paper made in Upper and Lower Canada was from rags. With the development of wood pulping techniques, Canada with its abundant forests and extensive water resources soon began to produce pulp from wood. By 1871, the industry in Canada was comprised of 21 mills which employed 760 workers. At the turn of the century, the industry had 6,236 employees working in 53 mills producing paper for mainly newspaper outlets that served small local domestic markets.

Over the thirteen year period 1900 to 1913, the provincial and federal governments passed a series of legislation that prohibited the export of pulpwood. The United States, in an attempt to relieve the problems associated with a shortage of timber in the northeastern States, at first reduced their tariffs on paper and later totally eliminated them. Either one of these separate actions would have resulted in giving a tremendous boost to what was then a small fledging industry. However, the combined effect of the embargo and the lowering of tariffs resulted in establishing pulp and paper manufacturing as Canada's leading industry. By the outbreak of World War II the industry had grown to 106 mills which produced and exported newsprint, which accounted for more than 70 percent of the total domestic consumption in the United States.

The pulp and paper industry remains today Canada's leading manufacturer. It is comprised of 149 mills, 122 of which are direct discharge mills. It accounts for roughly three percent of Canada's gross national product. Pulp and paper manufacturing stands first among all Canadian industry in the value of production and total wages. It is second to only the steel industry in export production. It ranks third in terms of total value of shipments and is amongst the top four in total capital investment. It is one of the largest consumers of goods and services in the nation and is located in nine of Canada's ten provinces. It is the major or only source of employment in about 175 communities which have combined total resident populations of approximately 250,000 people.

Despite the very substantial importance of pulp and paper manufacturing to the national and regional economies, it is a cyclical industry which experiences wide business cycle fluctuations. These fluctuations are accentuated by the large capital investment requirements of the industry. They also are exacerbated by the tendency within the industry to increase production capacity in response to increases in demand and higher prices. Price discounting during periods of low market demand, prolongs the length and deepens downturns in the business cycle. Pricing practices and large capital expenditure requirements help retard ease of entry and exit from the industry.

The industry's percentage contribution to total income and employment has declined both nationally and regionally since the end of World War II. The total level of production has grown, but it represents a declining proportion of total world output. These generally poor performance indicators can be attributed to two factors. These include the overall improvement that has taken place in the world and Canadian economies over the past 35 years, and the very substantial commitment on Canada's existing forest resource base.

When each of these two factors are examined in detail, it becomes readily apparent that the industry continues to be a very important, integral part of the Canadian economy. For example, the decline that the pulp and paper industry has experienced over time is a relative decline that results from growth and diversification in both the world and Canadian economies. As the world and domestic economies have grown and become more diversified, the overall level of trade and output has increased so that traditional sources of employment and income have declined in relative terms. Similarly, the existing very substantial commitment of Canada's forestry base does not mean that the present levels of output cannot be sustained. What it does suggest is that the economically accessible timber available in Canada is being used close to full potential. It means that the industry has reached a level of maturity whereby the growth rates that were experienced in the past are no longer possible. The industry can continue to grow, but all such growth will have to come as a result of improvements in wood utilisation and by increases in market share.

A relative decline in overall performance does not imply that an industry is on the demise, but neither does it indicate that an industry will continue to be successful in future. The historical success of the Canadian pulp and paper industry is dependent on three factors. These are: (1) the continued access to a readily available supply of good quality pulpwood, (2) continued access to international markets, and (3) the economic efficiency of mills located in Canada relative to the rest of the world. On the basis of the examination undertaken in this Chapter, it was found that even though the quality and quantity of economically accessible pulpwood is limited there is no reason to believe that this will necessarily have an undesirable effect on the future competitiveness of Canadian produced pulp and paper in international markets. In fact, if it results in the more efficient use of existing wood pulp supplies, it would ultimately further improve the industry's competitive position in world markets. The ability of Canadian producers to strengthen their international sales has potential, because of the foothold that has been established in these markets over many years. The industry is dependent on the United States domestic market for the sale of its products, but it is also true that the United States domestic market will continue to depend on Canadian production as long as the products are competitively available.

The large capital investments that were made in the industry over the last decade were exacerbated by the recession that took place in the early 1980's. However, these investments point to the industry's determination to modernise so that it can continue to compete successfully. Large-scale investments have resulted in lower returns to capital, but these declines are at least partially offset by the progress the industry has made in the more efficient use of its human resources. Despite the possibility of the development of new fiber sources, the level of investment which has taken place in the industry during the last few years, suggests that there exists a great deal of international confidence in the ability of the industry to sustain itself as one of the world's leading producers of pulp and paper. Overall, it does not appear to be an industry on the demise, but rather one that has put itself in a position for strong performance in future.

The very significant success that the pulp and paper industry has enjoyed in world markets is to a large extent the result of the imagination, skills, and energies of those who work in the industry. The collective willingness of the industry to be innovative and adopt new approaches has resulted in continual improvements in both products and productivity over time. The importance of these innovations in international markets is revealed most clearly by the historical role that Canadians have played in contributing to the techniques used within the industry worldwide. It also is reflected in the part that the industry has played in contributing to a distinctly Canadian mosaic. The industry is known to virtually every Canadian, whether living in a large metropolitan area or in a remote rural location. The industry is largely Canadian owned and controlled. One way or another, the pulp and paper industry has effected the lives of virtually every Canadian for many generations.

The Canadian pulp and paper industry produces many benefits for Canadians, but these benefits are achieved at a cost. The industry is a major user of the nation's publicly owned forests and water resources, and has the potential for having a significant negative impact on these resources if appropriate safeguards are not taken. The pollutants discharged from pulp and paper mills affect both water and air. In Canada it has been estimated that the industry has been responsible for 50 percent of all the waste dumped into the nation's waters. It can be estimated that it accounts for roughly 5.6 percent of the common air contaminants from known industrial sources.

The industry's very high profile among the general public and government officials results from its economic importance in Canada. However, it is the industry's use of publicly owned resources together with the potential environmental harm which can result from its operations, which serve as the main reasons for the long-standing strong relationship with government. Government efforts to limit the waste discharge from the pulp and paper industry evolves naturally from these long-standing relationships. More importantly, it evolves from the obligations that government has to protect the overall interests of the Canadian people.

Finally, the generally favourable future of pulp and paper manufacturing in Canada, as suggested in this Chapter, should not be interpreted to mean that business downturns or failures will not continue to occur in the industry. In all economically healthy sectors of the economy, change and evolution are an inevitable part of long-term success. The potential implications of cyclical fluctuations to the environmental performance of the pulp and paper industry will be discussed in greater detail later in the report.

CHAPTER TWO

The National and Regional Implications of the Pulping Processes Used in the Pulp and Paper Industry from an Environmental Perspective

Canada is only one of more than 70 different nations that produce pulp and paper products. It is a leading nation in the production of these products, but as noted in Chapter One its success is predicated on its ability to compete in world markets. The ability of Canadian manufacturers to compete in world markets, in turn, depends on the market acceptability of the products produced, and the relative overall costs of manufacturing these products. In this Chapter, the intention is to review the production methods of the industry, their characteristics, and how they have changed over time. The potential loadings which might occur from each of the manufacturing phases are assessed in terms of their actual contribution to total mill discharge. The principal factors that have influenced the direction of the industry are related to the environmental abatement techniques used and the overall environmental performance of the industry. These interrelationships are examined against the national and regional implications for protecting the environment. The overriding purpose is to provide some insight into the role that economic conditions within the industry play in both directly and indirectly determining the quality of the environment in which Canadians live.

The Processes Used in Canada and Their Inherent Environmental Characteristics

The paper producing processes used in Canada have changed dramatically over the years.[1] As noted in Chapter One, up until the 1860's paper was made mainly from rags. With the development of wood pulping the industry became divided into three classes. The three are: (a) mills which produce only pulp as part of a broader integrated operation or for sale in the marketplace; (b) mills that produce both pulp and paper within a single facility (an integrated mill); (c) mills that produce only paper, or paper related, final products.[2] Those facilities that produce only pulp, or pulp and paper combined, are the most difficult from an environmental standpoint.[3] This is not to suggest that mills which produce only paper do not require environmental safeguards, only that the environmental problems caused by paper mills are more straightforward than is true of mills that utilise the processing techniques required to produce pulp.[4]

The development and implementation of the various pulping processes used in Canada illustrate the evolving economic and market circumstances of the industry over time. Fundamentally, the aim of pulping is to liberate the fiber from wood so that it can be used as the basic raw material for paper making. The first, and for many years subsequent to the mid 1860's, the most widely used pulping method in Canada was the stone-groundwood process. The most obvious advantage for using this type of process is its high level of yield (over 90 percent of the dry weight), which reduces wood requirements, minimises costs, and generates less solid waste residuals. A major disadvantage is that the fibers are damaged during the pulping process and the resulting pulp lacks strength. The stone-groundwood process requires substantial amounts of energy and is highly labour intensive. The very high energy costs associated with this process was a main reason why most stone-groundwood mills were originally located next to waterways suitable for hydraulic and hydro-power development.

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[1] The descriptive comments provided in this Chapter on the pulping processes used in Canada depend heavily on the following publications: James P. Casey, Pulp and Paper Chemistry and Chemical Technology, 3rd. ed., Vols. I and II, John Wiley and Sons, New York, 1980. Howard Edde, Environmental Control for Pulp and Paper Mills, Pollution Technology Review No. 108, Noyes Publications, New Jersey, 1984. Allan M. Springer, Industrial Environmental Control Pulp and Paper Industry, John Wiley and Sons, New York, 1986. Sources are cited as appropriate throughout the presentation.

[2] The Pulp and Paper Industry 1928-1929, Dominion Bureau of Statistics, Census of Industry, Forest Products Branch, 1930, p.9.

[3] Environmental Considerations in the Pulp and Paper Industry, World Bank, Washington, D.C., 1980, p.6.

[4] Ibid., p.42. D. McLeay and Associates, Aquatic Toxicity of Pulp and Paper Mill Effluent: A Review, EPS 4/PF/1, Conservation and Protection, Environment Canada, Ottawa, April 1987, p.14.

The strength and versatility of chemical pulp resulted in the rapid adoption of chemical pulping techniques soon after they were first developed in the early 1850's. The first chemical pulping method used in Canada was the soda process. The advantages of this process were the wide variety of species of woods that could be used for pulp production, and the resulting paper provided a good print surface.[5] While generally credited with producing better quality pulp than was true of the mechanical processes of the time, it was expensive and lacked the strength demanded in the marketplace. Soda processing soon became extinct in Canada giving way to the less costly, and less environmentally disruptive sulphite pulping process during the early part of this century.

For many years the most popular and widely used chemical pulping method in Canada was the sulphite process. The sulphite process dominated in Canada up until the late 1930's and early 1940's, accounting for more than one-third of total production. A main advantage of sulphite pulp is that it does not require extensive bleaching to produce a reasonably bright paper. It is a versatile pulp that is well suited for producing better quality papers and even artificial silk. The stronger fibers obtained from this process are mixed with mechanical pulp in approximate proportions of 25 percent sulphite to 75 percent groundwood to give greater overall strength to newsprint grades.[6] After 1935, advances in plant design, coupled with the technological improvements, resulted in reducing the cost of kraft or sulphate pulping sufficiently to put sulphite pulp at a distinct disadvantage in the marketplace. However, the single most important reason for the decline in the popularity of sulphite pulping was then, as it remains today, the high costs associated with implementing and operating a spent liquor recovery system. Failure to recover chemicals not only renders this system of pulping relatively expensive as an alternative to kraft, but potentially a great deal more disruptive to the environment.

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[5] Nathan Reich, National Problems of Canada: The Pulp and Paper Industry in Canada, Department of Economics and Political Science, McGill University, St. Martin House, Toronto, 1926, p.11.

Originally developed for the purpose of reducing the cost of manufacturing soda pulp, kraft processing remained secondary to the sulphite pulping method for many years in Canada and elsewhere. Prior to the 1930's, the pulp produced using the kraft processes, (as is true of sulphite pulp today), was the more appropriate pulping method for certain end products. The principal advantage was that the pulp that resulted from this process was stronger than any of the alternatives. The main disadvantage was its limited versatility in terms of the dark pulp produced. Once a black liquor recovery furnace was developed, which permitted the efficient recovery of chemicals and at the same time generated most of the steam required in a mill, the popularity of the stronger pulp producing kraft process increased rapidly. The utility of the kraft process further improved with the introduction of new bleaching techniques.[7] As a result, the kraft process is the dominant chemical pulping method used in Canada today. It not only produces a versatile pulp that can be efficiently used to manufacture a wide variety of different products, but because of efficient chemical recovery offers some advantages for protecting the environment.

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[6] Ibid., p.10. Toxicity of Effluents from Sulphite Pulping Operations Practicing Recovery and Biological Treatment, Economic and Technical Review, Report EPS 3-WP-79-9, Water Pollution Control Branch, October 1979, p.2. High yield sulphite pulping is a modern variation of the conventional sulphite process, which in some cases become akin to mechanical pulping with chemical assistance.

The relatively rapid shift from sulphite to kraft production that took place within the industry is revealed by the information presented in Table 2:1. This Table shows the annual production of pulp in Canada for each of three different years over the 40 year period 1944 to 1984. According to the information contained in the Table, sulphite pulp accounted for 30.5 percent of the total output of the industry in 1944, 24.6 percent in 1964, and just under nine percent in 1984. In contrast, kraft production went from almost nine percent in 1944, to almost 26

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[7] Kraft pulps are more difficult to bleach to a given brightness level than is the case with sulphite pulps. This contributes to a substantial amount of the concern about the environmental impact of kraft pulping. See: The Basic Technology of the Pulp and Paper Industry and Its Environmental Protection Practices, Training Manual EPS 6-EP-83-1, Environmental Protection Programs Directorate, October 1983, P.74. A.G. Colodey, Impact of Pulp Mill Effluents In Sweden, Finland and Norway: Emphasis on Chlorinated Compounds, Draft Discussion Paper, Environmental Protection, West Vancouver, July 1988.

TABLE 2:1

ANNUAL PRODUCTION OF WOOD PULP ACCORDING TO PULPING PROCESS 1944, 1964, AND 1984
(000's tonnes)

	1944		1964		1984	
	#	%	#	%	#	%
Groundwood	2,793	58.4	5,732	47.3	8,395	41.4
Sulphite[1]	1,458	30.5	2,981	24.6	1,797	8.9
Kraft (Sulphate)	426	8.9	3,138	25.9	9,442	46.5
Others[2]	105	2.2	254	2.1	659	3.3
Total	4,782	100.0	12,105	100.0	20,293	100.0

[1] Includes dissolving and special alpha grades.
[2] "Others" category for 1944 includes screenings exports.

Sources: Pulp and Paper Facts and Figures, Canadian Pulp and Paper Association, March 1946. National Directory of Canadian Pulp and Paper Industries, 1965/66. Reference Tables, Canadian Pulp and Paper Association, 1986.

percent in 1964, and to 46.5 percent in 1984. In an industry where a number of mills are more than a century old, and where capital costs require a fairly lengthy period over which to recover investment, the reversal in position between kraft and sulphite production during the 1944 to 1964 period has to be considered dramatic. The fact that this trend continued into the 1980's serves to emphasise the importance of production costs in determining the pulping processes used within the industry.

The shift between sulphite and kraft production does not unto itself reveal the extent of the innovative processes that have been adopted within the industry since the turn of the century. It should be noted from the information presented in Table 2:1, that groundwood production declined only slightly between 1944 and 1984. The obvious reasons for this is the increasing cost of wood supply and the very high yield that is obtained from mechanical pulping. As a result, the industry continues to mix the higher strength chemical pulps with mechanical pulps in proportions of roughly 80 percent mechanical pulp to twenty percent chemical pulp, depending on the processing method and final use. The utility associated with this in terms of the cost reductions that can be achieved, has maintained groundwood pulp as an attractive part of the overall production of the industry for many years. This has led to the development of new types of mechanical pulping which are designed to produce better quality pulp at costs appropriate to market prices.

In the 1950's, refiner mechanical pulping (RMP) was introduced.[8] The advantage of this method is that it continues to obtain the typically high yield of groundwood processing techniques, while requiring less labour. The disadvantage is that it requires more energy.[9] Even though the pulp produced using this process is of better quality than stone-groundwood, it is considered inferior to the pulp produced in existing chemical processes.[10] In what appears to have been a deliberate effort to improve on the quality of refiner mechanical pulp, thermo-mechanical pulping (TMP) was introduced in Canada in 1973.[11] Although more expensive and more energy consuming, the pulp produced using this technique is of superior quality to refiner mechanical pulp. Newsprint has been produced solely from thermo-mechanical pulp, but usually chemical pulp is added to supplement its strength. Thus, the logical next step was the development of chemi-thermo-mechanical pulping (CTMP), which occurred in the late 1970's. The energy requirements using this technique are less than for either refiner mechanical pulping or TMP, but because of higher pretreatment requirements in TMP and CTMP, both of these processes pose a greater threat to the environment than either refiner mechanical or stone-groundwood pulping.[12]

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[8] Basic Technology, op. cit., p.30.

Although the processes described here cover the major categories of pulping processes used in the industry, there are a wide number of different pulping techniques that can be used to facilitate the production of pulp with different characteristics. Some are a combination of mechanical and chemical processes such as is the case with the neutral sulphite semi-chemical (NSSC) method and the high yield kraft process.[13] Others, are in fact variations of the basic conventional techniques which are employed to suit the characteristics that are being sought in the end product.

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[9] G.A. Smook, Handbook for Pulp and Paper Technologists, Joint Textbook Committee of Paper Industry, p.55.

[10] Environmental Considerations, op. cit., p.3.

[11] Basic Technology, op. cit., p.31.

[12] Environmental Considerations, loc. cit., p.3.

[13] Ibid., p.4.

In addition to the more conventional pulping techniques, for many years in Canada there has been a growing trend to the repulping of waste materials.[14] In some cases, rag pulp is made from cotton and linen and used as an additive to produce higher grade papers. However, most repulping involves the use of waste papers as the basic fiber ingredient for the production of roofing materials, paperboard, and other building products. Fine quality waste paper is used to produce newsprint. The advantage of repulping is that it is relatively inexpensive, once the waste paper is collected. Although some chemicals are normally used for deinking, repulping is generally considered less environmentally disruptive than most pulping processes.

The Economic Motivations for Growth and Change

The foregoing chronological review of the changes that have taken place in the industry suggests that the consumer's preference for strength, versatility, and brightness has had a major long-term influence on the processes that are used by industry. The most readily apparent early example of this was the introduction and rapid adoption of chemical pulping when developed in the mid 1800's. Because of strength and versatility, chemical pulp did then as it does today, command a higher selling price than stone-groundwood pulp.[15] The importance of strength was further revealed when the dark coloured kraft pulp was so readily accepted in the market, after its first introduction. However, it only became dominant when a new bleaching process was introduced that made it feasible to achieve a level of brightness consistent with what was preferred in the market. In fact, kraft exports serve as a good indication of the role that market preferences for strength, brightness, and versatility have played in establishing kraft pulping as the most widely used pulping process in the industry today.

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[14] According to the Canadian Pulp and Paper Association, one million tonnes of waste paper was recycled into newsprint products in 1979. See: CPPA, From Watershed to Watermark, January 1980, p.6.

Table 2:2 is used to show the percentage of the total pulp produced in each of the main pulp processing categories that was exported during 1944, 1964, and 1984. According to the information in this Table, the percentage of the total production exported in each of these major process categories shifted in a similar, but more pronounced manner than did production over the 40 year period 1944 to 1984. For example, a comparison between Tables 2:1 and 2:2 shows that kraft pulp accounted for nine percent of total production in 1944, and 38 percent of that production was exported. In 1984, kraft accounted for 46.5 percent of total production, but 63.1 percent was exported. In contrast, sulphite accounted for 30.5 percent of total production in 1944, while 60.4 percent of this production was exported. In 1984, sulphite pulp accounted for almost nine percent of the total production, but somewhat less than 21 percent of this total production was exported. Kraft pulp has been the preferred choice in the marketplace for virtually all of the 40 years shown on these Tables. The data contained in Tables 2:1 and 2:2, together, indicate

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[15] Environmental Considerations, op. cit., p.4.

TABLE 2:2

THE PERCENTAGE OF MARKET PULP EXPORTED ACCORDING TO THE TOTAL PRODUCTION IN EACH OF THE MAIN PULPING PROCESSES 1944, 1964, AND 1984

	1944 %	1964 %	1984 %
Groundwood	7.3	4.2	4.5
Sulphite[1]	60.4	38.9	20.9
Kraft (Sulphate)	38.3	58.2	63.1
Others[2]	27.1	13.8	50.5

[1] Includes dissolving and special alpha grades.

[2] "Others" category for 1944 includes screenings exports.

Sources: Pulp and Paper Facts and Figures, Canadian Pulp and Paper Association, March 1946. National Directory of Canadian Pulp and Paper Industries, 1965/66. Reference Tables, Canadian Pulp and Paper Association, 1986.

that for many years groundwood pulp has been produced mainly for domestic manufacturing.

The dominance of a kraft pulp is more clearly displayed by the information presented in Table 2:3. Table 2:3 is used to provide information that shows the distribution of pulp exports according to major process categories in 1944, 1964, and 1984. The information in this Table clearly shows that kraft pulp is the preferred pulp in Canada's export markets. Kraft pulp exports accounted for 12.8 percent of all Canadian pulp exports during 1944, and in 1984 it accounted for close to 85 percent of all Canada's pulp exports. It is apparent from this information, that unless the disadvantages associated with substantial bleaching requirements become a major production or environmental problem in future, kraft pulp will remain one of Canada's most important virgin pulp products for many years.

The same properties that have given kraft pulp its preferred status in the marketplace, also contribute to the rapidly growing trend to the more recently developed mechanical processes. TMP offers greater strength, versatility, and brightness than do stone-groundwood or RMP. Depending on the wood used for pulping, brightness levels that do not require bleaching often are achieved using this process. CTMP can be used to produce acceptable quality groundwood pulp,[16] and the strength of the pulp produced using this process often approaches that of the low yield chemical pulps.[17] The strength of the chemi-thermo-mechanical pulp makes it particularly suitable for use in the high speed modern paper

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[16] Casey, op. cit., pp.243-244.
[17] Ibid., p.247.

TABLE 2:3

DISTRIBUTION OF WOOD PULP EXPORTS ACCORDING TO MAJOR PROCESS CATEGORY 1944, 1964, AND 1984
(000's tonnes)

	1944		1964		1984	
	#	%	#	%	#	%
Groundwood	203	15.9	266	7.4	379	5.4
Sulphite[1]	881	69.1	1,282	35.6	375	5.3
Kraft (Sulphate)	163	12.8	2,013	55.9	5,953	84.6
Others[2]	29	2.3	40	1.1	333	4.7
Total	1,276	100.0	3,601	100.0	7,040	100.0

[1] Includes dissolving and special alpha grades.
[2] "Others" category for 1944 includes screenings exports.

Sources: Pulp and Paper Facts and Figures, Canadian Pulp and Paper Association, March 1946. National Directory of Canadian Pulp and Paper Industries, 1965/66. Reference Tables, Canadian Pulp and Paper Association, 1986.

machines used in the industry today.

Even though the production processes used within the industry have changed considerably over the long-term, within this general pattern of market-oriented growth, there has been the tendency to develop and adopt new technologies for the purpose of reducing production costs. The first pulp mills were built in an era when wood was abundant, energy was plentiful, chemicals were inexpensive, and labour costs were low. As the cost of each of these factor inputs increased, technological innovations were developed to offset rises in overall production costs. Once stone-groundwood pulping was introduced, it was readily adopted in the industry partially because wood was cheaper and more readily available than rags. The labour intensive nature of wood harvesting and stone-groundwood pulping often complimented the other employment opportunities (i.e. fishing and farming) available in rural areas. The lower fiber recovery associated with chemical pulping did not hinder the fairly rapid adoption of either soda or sulphite processing, because good quality pulpwood was inexpensive and readily available. However, the high cost of soda pulping soon led to the development and introduction of kraft pulping.[18]

Although kraft pulping was developed with the intention of reducing the costs of soda pulping, sulphite pulping continued to be the preferred process for many years. Sulphite processing remained the dominant chemical pulping method until efforts which were deliberately undertaken to reduce the cost of kraft chemical pulping,[19] resulted in the introduction of a recovery furnace. This furnace not only allowed the recovery of the cooking chemicals, but as noted previously, generated much of the steam that is required at a mill. The fibers that are obtained from kraft processing necessitated additional bleaching. Nonetheless, these costs were largely offset by the subsequent introduction of new bleaching processes.

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[18] The Pulp and Paper Industry 1928-1929, Dominion Bureau of Statistics, Census of Industry, Forest Products Branch, 1930, p.10.

[19] Springer, op. cit., p.119.

As the cost of labour rose in the 1950's, the less labour intensive and higher energy consuming refiner groundwood pulping was introduced. Concern over the continued availability of good quality wood supplies gave rise to the development of TMP in the 1970's. The development of a TMP heat recovery system substantially reduced the energy costs associated with this process.[20] The development of CTMP, the Ontario Paper Corporation Process (OPCO), and the closed-cycle bleach kraft mill are recent innovative technologies that offer opportunities for energy savings, higher fiber yield, chemical use reductions, and reduced water consumption in future.[21]

The Influence of Growth and Change on Environmental Performance

The foregoing illustrates the important role that market demand and cost of production considerations play in influencing growth and change within the industry. Somewhat less apparent is the very significant role that these economic factors play in determining the environmental performance of the industry over time. The pollution loadings from pulp and paper manufacturing are normally classified into certain specific general pollution parameters, which are deemed to best characterise the total of the environmental pollutants from the industry. In Canada, the effluent parameters most commonly used are total suspended solids (TSS), biological oxygen demand (BOD), and toxicity to fish.[22] As is true of other Canadian industries, the parameters used to monitor the common air contaminants from industry include particulate matter, sulphur oxide, nitrogen oxide, hydrocarbon, and carbon monoxide. When these parameters are used to rank each of the pulp product and process capacity categories according to potential environmental impact, it becomes apparent that the pattern of changes within the industry is determined by two often contradictory economic influences. On the one hand, the long-term trend among Canadian pulp and paper manufacturers has been to develop and adopt production processes that result in better quality pulps. On the other hand, the industry has attempted to reduce its production costs by developing and implementing technologies that reduce the costs of manufacturing pulp and paper. The stronger brighter pulps demanded in the marketplace cost more to produce, because they require more processing, more materials input than lower grade pulps. The better the quality of pulp, the more product specifications, the greater the waste generated, and the more potentially environmentally disruptive the process.[23] The lower the materials input and processing refinement requirements, the less the production costs and the less the potential threat to the environment.

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[20] Ibid., p.151.

[21] Ibid., p.133.

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[22] The parameters used to regulate and monitor the pulp and paper industry varies among government agencies in Canada. In some cases, the provinces monitor and regulate pH and colour. In other cases, the provinces have chosen not to regulate toxicity, and have left the responsibility to the Federal Government. These variations in approach among regions in Canada are discussed again later in this report.

[23] Springer, op. cit., p.21.

The tendency of the Canadian industry to shift from the use of somewhat more environmentally disruptive pulping processes to less disruptive processes is revealed by the information presented in Tables 2:4(A) and 2:4(B), which shows the volumes of pulp produced in Canada for the years 1950 to 1984 according to pulping product category. The information contained in Tables 2:4(A) and (B) shows what are generally perceived to be the most environmentally disruptive pulping product categories at the top, with each less potentially damaging pulp product listed successively down the columns.[24] According to these data there has been a marked tendency within the industry to produce less environmentally disruptive pulps over the 34 years shown on the Table. The production of the potentially highly disruptive dissolving special alpha has been reduced from four percent of the total production in 1950 to 0.8 percent in 1984. As has been shown previously, there has been an industry-wide shift from the use of the somewhat more environmentally disruptive sulphite process to the less disruptive (the wastes are easier to control) kraft pulping. The significance of the shift between kraft and sulphite production, demonstrates the importance of production costs in motivating technological changes that reduce the potential threat to the environment.

However, the general tendency of the industry to develop and

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[24] The ordinal listings presented in Tables 2:4(A) and (B) are meant to provide the reader with some insight into the disruptive nature of each of the processes, one relative to the other. The reader should not interpret this to mean that all more potentially environmentally disruptive pulping categories necessarily cause greater harm to the environment, than all potentially less environmentally disruptive processes. The amount of actual damage that can be caused to the environment depends on a number of different factors which would include, but are not necessarily be limited to, the design of the mill, the environmental safeguards that are adopted at a mill, and the attitude of employees.

TABLE 2:4(A)

WOOD PULP PRODUCTION (OUTPUT) ACCORDING TO PULPING PROCESS AND ENVIRONMENTAL SENSITIVITY[1]
1950 TO 1970 (000's tonnes)[2]

	1950		1955		1960		1965		1970	
	#	%	#	%	#	%	#	%	#	%
Dissolving & Special Alpha	305	4.0	365	4.0	356	3.4	431	3.3	411	2.5
Sulphite Bleached	386	5.0	566	6.1	519	5.0	817	6.2	684	4.1
Sulphite Unbleached	1,315	17.1	1,625	17.6	1,560	15.0	1,836	13.9	1,870	11.2
Semi Chemical	94	1.2	141	1.5	203	2.0	177	1.3	295	1.8
Sulphate[3] Bleached	396	5.2	663	7.2	1,062	10.2	1,862	14.1	3,660	22.0
Sulphate Semi-Bleached	12	.2	55	.6	257	2.5	566	4.3	1,084	6.5
Sulphate Unbleached	548	7.1	617	6.7	896	8.6	1,114	8.4	1,341	8.1
Defibrated & Exploded	81	1.1	126	1.4	143	1.4	170	1.3	259	1.6
Groundwood	4,455	57.9	4,960	53.9	5,335	51.3	6,170	46.6	6,940	41.8
Not otherwise specified and Screenings	96	1.2	92	1.0	66	.6	77	.6	64	.4
	7,688	100.0	9,210	100.0	10,397	100.0	13,220	100.0	16,608	100.0

[1] The production process categories are listed from top to bottom according to potential environmental impact. The most environmentally stressful are listed at the top with each successively less stressful production process listed sequentially down the process category column.

[2] It should be noted that production totals in metric tonnes are not necessarily exactly the same as the totals published by CPPA due to rounding errors.

[3] These rankings do not take into account the potentially disruptive influences of organochlorines.

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistics Report on Industry.

TABLE 2:4(B)

WOOD PULP PRODUCTION (OUTPUT) ACCORDING TO PULPING PROCESS AND ENVIRONMENTAL SENSITIVITY[1]
1975 TO 1984 (000's tonnes)[2]

	1975		1980		1981		1983		1984	
	#	%	#	%	#	%	#	%	#	%
Dissolving & Special Alpha	226	1.5	271	1.3	274	1.3	169	.8	173	.8
Sulphite Bleached	516	3.4	463	2.2	488	2.4	360	1.8	435	2.0
Sulphite Unbleached	1,442	9.6	1,671	8.1	1,769	8.6	1,378	6.9	1,431	6.8
Semi Chemical	233	1.5	345	1.7	392	1.9	367	1.8	397	1.9
Sulphate[3] Bleached	4,219	27.9	6,580	31.8	6,278	30.5	6,745	33.7	6,894	32.7
Sulphate Semi-Bleached	863	5.7	1,185	5.7	1,009	4.9	1,053	5.3	1,100	5.2
Sulphate Unbleached	1,314	8.7	1,998	9.7	1,921	9.4	1,752	8.7	1,732	8.2
Defibrated & Exploded	263	1.7	384	1.9	311	1.5	260	1.3	275	1.3
Groundwood	6,007	39.8	7,748	37.4	8,085	39.3	7,913	39.5	8,647	40.9
Not otherwise specified and Screenings	28	.2	42	.2	44	.2	32	.2	39	.2
	15,111	100.0	20,687	100.0	20,571	100.0	20,029	100.0	21,123	100.0

[1] The production process categories are listed from top to bottom according to potential environmental impact. The most environmentally stressful are listed at the top with each successively less stressful production process listed sequentially down the process category column.

[2] It should be noted that production totals in metric tonnes are not necessarily exactly the same as the totals published by CPPA due to rounding errors.

[3] These rankings do not take into account the potentially disruptive influences of organochlorines.

Source: Reference Tables, Canadian Pulp and Paper Association, Annual Statistics Report on industry.

adopt less environmentally disruptive processing methods, does not mean that in every instance all new processes, or process modifications, will result in improvements that are less threatening to the environment. The implicit contradictory nature of the market forces influencing the environmental performance of the industry often reflects itself in what would appear to be paradoxical environmental performance patterns over time.

This somewhat paradoxical behaviour is revealed by a comparison of the information contained in Tables 2:4(A) and (B) with Tables 2:5(A) and (B). As would be anticipated in an industry with strong economic incentive to adopt cleaner processes over time, the information contained in 2:4(A) and (B) shows a marked tendency with the industry to produce pulps that are less environmentally disruptive. However, the information contained in Tables 2:5(A) and (B), which provides information on the production capacity of the industry according to pulping process category for the years 1973 to 1987, shows that the biggest increase in production capacity is in the TMP category. TMP production capacity has risen from five percent of the total capacity in 1980 to 17.6 percent in 1987. The production capacity for RMP and stone-groundwood pulp declined slightly during this same period. On the basis of these comparisons, it can be seen that TMP is not of itself less environmentally disruptive than either RMP and stone-groundwood processing. The trend within the industry over the last seventeen years has not in every case been to cleaner production processes.

The general trend to TMP processing reveals a pattern that is

TABLE 2:5(A)

PRODUCTION CAPACITY IN THE PULP AND PAPER INDUSTRY[1]
ACCORDING TO MAJOR PROCESSING CATEGORY
AND ENVIRONMENTAL SENSITIVITY[2]
1973 TO 1987
(000's tonnes)

PROCESS CATEGORY	1973		1974		1975		1976		1977		1978		1979		1980	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Dissolving & Special Alpha[3]	416	1.9	404	1.8	427	1.9	408	1.8	353	1.5	424	1.9	395	1.7	307	1.4
Sulphite Bleached	622	2.9	689	3.1	794	3.5	807	3.5	727	3.2	580	2.6	512	2.2	426	1.9
Sulphite Unbleached	2,017	9.4	2,144	9.7	2,131	9.5	2,134	9.4	2,119	9.3	2,091	9.2	2,100	9.1	2,062	9.2
Semi-Chemical (NSSC)	392	1.8	390	1.8	400	1.8	426	1.9	454	2.0	455	2.0	459	2.0	438	2.0
Kraft (Sulphate) fully Bleached	5,495	25.6	5,894	26.5	6,133	27.2	6,189	27.1	6,383	28.0	6,551	28.9	6,980	30.2	7,131	31.8
Kraft (Sulphate) semi-bleached	1,249	5.8	1,264	5.7	1,203	5.3	1,189	5.2	1,191	5.2	1,216	5.4	1,258	5.4	1,198	5.3
Kraft (Sulphate) unbleached	1,967	9.2	2,087	9.4	2,132	9.4	2,157	9.5	2,062	9.0	1,824	8.1	1,807	7.8	1,752	7.8
Defibrated and Exploded	389	1.8	408	1.8	399	1.8	398	1.7	392	1.7	402	1.8	413	1.8	350	1.6
Thermo Mechanical (TMP)	-	-	-	-	69	.3	380	1.7	533	2.3	544	2.4	717	3.1	1,115	5.0
Refiner Mechanical (RMP)	542	2.5	549	2.5	581	2.6	622	2.7	702	3.1	847	3.7	883	3.8	792	3.5
Groundwood/ Refiner Mechanical	152	.7	176	.8	173	.8	178	.8	179	.8	195	.8	197	.9	192	.9
Stone Groundwood(SGW)	8,110	37.7	8,167	36.7	8,046	35.7	7,892	34.6	7,689	33.7	7,446	33.0	7,410	32.0	6,643	29.6
Other, not otherwise specified, includes screenings	147	.7	53	.2	44	.2	38	.1	38	.2	36	.2	-	-	-	-
	21,498	100.0	22,225	100.0	22,532	100.0	22,818	100.0	22,822	100.0	22,611	100.0	23,131	100.0	22,406	100.0

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[1] These data are based on an annual industry survey conducted by the CPPA and the totals are estimated to represent over 95 percent of capacity of the industry.

[2] The production process categories are listed from top to bottom according to potential environmental impact. The most environmentally stressful are listed at the top with each successively less stressful production process listed sequentially down the process category column.

[3] This grade of pulp is not produced in any mill in Canada without full recovery.

[4] Data for 1986 and 1987 years are taken from 1985 Reference Tables, which for most years corresponds with figures presented in Canadian Pulp and Paper Capacity report.

Source: Canadian Pulp and Paper Capacity, published by the Canadian Pulp and Paper Association, May 1986.

TABLE 2:5(B)

PRODUCTION CAPACITY IN THE PULP AND PAPER INDUSTRY[1] ACCORDING TO MAJOR PROCESSING CATEGORY AND ENVIRONMENTAL SENSITIVITY[2] 1973 TO 1987 (000's tonnes)

PROCESS CATEGORY	1981		1982		1983		1984		1985		1986[4]		1987	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Dissolving & Special Alpha[3]	303	1.3	305	1.3	267	1.1	264	1.1	266	1.1	260	1.1	256	1.0
Sulphite Bleached	461	2.0	436	1.9	391	1.7	371	1.6	572	2.4	429	1.8	442	1.8
Sulphite Unbleached	2,119	9.2	1,950	8.4	1,734	7.4	1,634	6.9	1,414	5.9	1,504	6.1	1,509	6.1
Semi-Chemical (NSSC)	445	1.9	445	1.9	462	2.0	472	2.0	449	1.9	476	2.0	477	2.0
Kraft (Sulphate) fully Bleached	7,326	31.9	7,324	31.6	7,613	32.5	7,889	33.1	8,057	33.7	8,105	33.1	8,175	33.1
Kraft (Sulphate) semi-bleached	1,106	4.8	1,236	5.3	1,169	5.0	1,127	4.7	1,085	4.5	1,115	4.6	1,120	4.5
Kraft (Sulphate) unbleached	1,788	[illegible].8	1,759	7.6	1,734	7.4	1,735	7.3	1,719	7.2	1,741	7.1	1,752	7.1
Defibrated and Exploded	352	1.5	366	1.6	366	1.6	366	1.5	299	1.2	366	1.5	366	1.5
Thermo Mechanical (TMP)	1,738	7.6	2,383	10.3	3,135	13.4	3,563	14.9	3,811	15.9	4,167	17.0	4,354	17.6
Refiner Mechanical (RMP)	725	3.2	738	3.2	523	2.2	423	1.8	394	1.7	375	1.5	375	1.5
Groundwood/ Refiner Mechanical	171	.8	181	.8	175	.7	175	.7	181	.8	175	.7	175	.7
Stone Groundwood(SGW)	6,413	27.9	6,042	26.1	5,861	25.0	5,827	24.4	5,656	23.7	5,760	23.5	5,704	23.1
Other, not otherwise specified, includes screenings	14	.1	-	-	-	-	-	-	-	-	-	-	-	-
	22,961	100.0	23,165	100.0	23,430	100.0	23,846	100.0	23,903	100.0	24,473	100.0	24,705	100.0

[1] These data are based on an annual industry survey conducted by the CPPA and the totals are estimated to represent over 95 percent of capacity of the industry.

[2] The production process categories are listed from top to bottom according to potential environmental impact. The most environmentally stressful are listed at the top with each successively less stressful production process listed sequentially down the process category column.

[3] This grade of pulp is not produced in any mill in Canada without full recovery.

[4] Data for 1986 and 1987 years are taken from 1985 Reference Tables, which for most years corresponds with figures presented in Canadian Pulp and Paper Capacity report.

Source: Canadian Pulp and Paper Capacity, published by the Canadian Pulp and Paper Association, May 1986.

also being experienced for other types of processes. Although not shown on the Tables, in recent years there has been a very substantial shift to bleached chemi-thermo-mechanical pulping (BCTMP) and CTMP production. The use of these two pulping processes is projected to increase even more rapidly over the coming years.[25] Both BCTMP and CTMP are more environmentally disruptive than other types of groundwood pulping. Even though they appear to offer a number of advantages in terms of protecting the environment, they may be more environmentally disruptive than some of the chemical processes. The reduced water flow of these processes, combined with higher fiber recovery which releases large amounts of lignins, results in giving these processes greater propensity to generate toxic effluent. The advantage of adopting TMP, CTMP, and BCTMP processes obviously does not lie in the potential benefits that occur to the environment, but in the more attractive nature of the pulp produced.

As noted previously, CTMP is popular because of the strength, brightness, and versatility of the pulp produced using this process. The amount of processing required to achieve product characteristics considered attractive in the marketplace is less than it is for other processes that can be used to produce products with less consumer appeal. The high yield of CTMP (90 to 92 percent as compared with kraft with 40 to 42 percent), its lower energy requirements, and the range of wood species that can be used in this process, together, contributes to its attractiveness. The attractiveness of CTMP is enhanced considerably by the fact that both wood and chemicals represent an ever growing portion of the total cost of producing pulp. For example, it is estimated that a new CTMP mill that produces 550 tonnes of pulp per day will cost about $200 million, and will consume about 500 tonnes of fiber.[26] The estimated cost of building a new kraft mill that produces 1,000 tonnes of pulp per day is estimated at $500 million and will consume between 2,000 and 2,500 tonnes of fiber daily.[27] It can be anticipated that the excellent quality of the pulp produced from the CTMP process, combined with the relatively inexpensive production costs associated with this type of production, will ensure its continued popularity in future. This will occur despite the fact that it is generally agreed that the environmental problems associated with this process are not fully known, and in some cases may be more onerous than the conventional processes currently used within the industry.[28]

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[25] John Mullinder, "Industry to Spend $1.3 Billion This Year, $4.3 Billion by 1991", Pulp and Paper Journal, Vol. 40, No. 5, May/June 1987, pp.48-49.

The apparent contradiction between the industry's propensity to develop and use cleaner processes over the longer term and the observed tendency of the industry to adopt what have often been potentially more environmentally disruptive processes, can be explained best in terms of the underlying motivation for such behaviour. Because the higher grade pulps can be used more readily to produce products preferred by consumers, they command higher market prices, but they also result in the generation of greater volumes of waste. The lower grade pulps, which generally result in less waste generation, command a lower price in the marketplace. Therefore, those pulps that have the greatest profit potential are the usually more environmentally disruptive higher grade pulps. The pulp and paper industry, like other commercial enterprises, is motivated by profit. The highest returns can be achieved by producing the more disruptive higher priced pulps, at the lowest possible costs. Therefore, even though the industry will expend a great deal of effort reducing its production costs over time, this does not necessarily mean that it will employ the least polluting processes.[29]

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[26] Doug Cowell, "Saw Mill Consortium Goes Against the Grain with New CTMP Mill", Pulp and Paper Journal, Vol. 40, No. 7, September 1987, p.29.

[27] Loc. cit.

[28] Springer, op. cit., pp.149-150.

On the basis of the discussion and information presented in this section, it can be concluded that the product characteristics demanded by consumers in the marketplace lean heavily toward the production of higher strength better quality pulps. As a result, the stronger, brighter, and more versatile pulps command higher market prices than lower grade pulps. They also cost more to produce because of the higher material input requirements, and as a result, are more environmentally disruptive. There exists, therefore, strong economic incentive for developing and introducing new technologies to improve production efficiencies. This sometimes leads to the development and manufacture of by-products.[30] It most often results in the recycling and reuse of production materials. In either case, industry's efforts to improve production efficiencies has resulted in a reduction in the overall amount of waste generated by the industry. This does not necessarily imply that the industry always will adopt less environmentally disruptive production techniques. More realistically, it can be anticipated that there will continue to be improvements in the environmental control technologies for those processes where the resulting pulps possess the characteristics demanded in the market.

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[29] The validity of this observation is revealed in North America by the industry-wide shift from sulphite to kraft pulping that took place over this century. The volume of effluent discharges from kraft pulping in the United States has been reduced by 75 percent over the period 1900 to 1982, while the problems associated with controlling waste discharges from sulphite mills in many instances has rendered these mills obsolete. This not only helps to demonstrate the importance of market preferences in influencing the use of particular processes, but it further emphasises the very major influence that profitability has on motivating technological changes that reduce the potential threat to the environment. See: Ibid., pp.20, 122, 325.

[30] There are numerous by-products that can be produced from the waste materials generated in pulp and paper production. In some cases, these by-products produce a profit independent of the pulp and paper operations. In other cases, the manufacturing of these by-products make a small contribution to overhead, but reduce the amount of waste that results from operational processes. Examples of where by-product production takes place in Canada include the Reed Paper Company Limited in Quebec City, and up until recently, the Ontario Paper Company in Thorold, Ontario.

Actual as Opposed to Potential Pollution Loadings

Like most other industries, the pollution problems caused by the pulp and paper industry result directly from the production methods used in manufacturing. Enormous quantities of water are used for moving wood within a mill, as well as for debarking, cooking, grinding, bleaching, chemical recovery and sheet forming. Each of these different phases can result in different effluent waste discharges, and depending on the circumstances, varying levels of air contaminant emissions (even though the impact of such emissions may be confined to a limited area).[31] Thus, the importance of the motivating factors that influence the development of pollution control mechanisms ultimately depends on the effectiveness of the technologies that are adopted. The effectiveness of the pollution control technologies that are adopted depends on the difference between the pollution loadings that would occur in the absence of implementing pollution control mechanisms, and the amount that actually occurs once such control mechanisms have been implemented. Such comparisons can be made on the basis of the manufacturing methods used, and the available information on effluent and air contaminants discharges.

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[31] The Basic Technology, op. cit., p.25.

The broadest practical distinction that can be made amongst the various processes is between chemical and mechanical pulping. When this distinction is applied universally on an industry-wide basis, it becomes apparent that there generally is little difference between the detectable pollution loadings that actually occur from these two distinctly different categories of pulping. The TSS discharges from mechanical pulping are usually greater than they are for chemical pulping, because of the large quantity of fines produced.[32] However, both types of pulping processes generate TSS in amounts that are harmful to the environment. The actual amount of TSS loadings that occur relate mostly to the efficiency of the equipment being used to remove solids.[33] Empirically, it has been found that the amount of BOD discharge varies inversely with pulp yield. As a consequence, BOD is less of a problem with the higher yield mechanical processes than it is in chemical pulping.[34] The major source of BOD is the escapement of spent liquor. Therefore, the amount of BOD loadings that are discharged from a particular chemical pulping facility depends on the efficiency of the chemical recovery system employed. The major nonvolatile toxic compounds generally are present in both these general categories of pulping.[35] Except for those substances emanating from the bleaching plant, the specific problems associated with toxicity appear to depend mostly on the type of wood being utilised, rather than on the properties intrinsic to the processing technology being employed.

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[32] Springer, op. cit., p.149.

[33] Ibid., p.21.

[34] Ibid., p.20.

[35] Ibid., p.13. E.P. Haydu, H.R. Amberg, and R.E. Dimick, TAPPI, Vol. 35, No. 12, 1952, p.545. C.C. Walden and T.E. Howard, TAPPI, Vol. 60, No. 1, 1977, p.122.

Another admittedly very simple model that can be used to examine the basic difference between potential and actual pollution loadings is a model presented by Allan M. Springer.[36] In this model Mr. Springer identifies the areas considered most in need of attention for pollution abatement activities within a fully integrated kraft mill. This hypothetical mill is specified on the basis of the potential TSS and BOD loadings that would be typically generated by each of five manufacturing areas. The separate manufacturing areas were specified as the wood yard, pulping, recovery, bleaching, and the paper mill. Accordingly, it was noted that empirical evidence revealed that in such an idealised integrated mill, the paper mill would most often produce more TSS than any other area. The recovery area would place a distant second.[37] The largest BOD loadings are produced by the bleaching plant, with pulping second, and paper manufacturing third.[38] At least on surface, this oversimplified view of the manufacturing areas used in an integrated mill would suggest that the main water pollution problems associated with pulp and paper manufacturing emanates from bleaching and paper manufacturing.[39] However, as almost everyone familiar with the industry would agree, this is not necessarily true for the vast majority of integrated mills. As is the case in many analyses of the pollution caused by the pulp and paper industry, such an overview merely points to the potential source of pollution in a mill.

Part of the difficulty in attempting to summarise actual as opposed to potential waste discharges and emissions, on the basis of the major processing categories, is that most mills in Canada (indeed throughout the world) use two or more processing methods either separately or in combination to manufacture pulp. Although it need not necessarily be so, many mills in Canada produce some combination of chemical and mechanical pulp. It nonetheless is accepted that many separate and distinctly identifiable production phases are applied in common throughout the industry. Included amongst these many different phases is bleaching. The chemicals used in bleaching are used on a once through basis, and as a result can account for 40 percent of BOD, 25 percent of TSS, and 70 percent of the colour loadings from a mill.[40] In fact, it is claimed that bleaching effluents can be the largest part of the total organic waste load from a pulp mill.[41] Important also is the knowledge that kraft pulp requires more extensive bleaching than pulp produced using other processing methods,[42] and that the recovery boilers which play such an important role in reducing the amount of chemical escaping from a mill are a major potential source of air pollution.[43] The overall implication is that bleaching could easily be assumed to be the main cause of much of the pollution that comes from the pulp and paper industry.[44]

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[36] Springer, op. cit., p.19.
[37] Loc. cit.
[38] Loc. cit.
[39] Loc. cit.

A literature review of the environmental implications of bleaching as it relates to each of the conventional processes, suggests that there is very little correlation between the potential problems that can result from this production phase and the detectable pollution loadings discharges which actually occur. Similar to the situation with toxicity noted above, the amount of bleaching required to achieve certain market acceptable levels of brightness for particular products using mechanical processing usually depends most critically on the wood species used in process.[45] The amount of bleaching required for sulphite pulp is less than it is for kraft production, but the difference in actual loadings that result from the bleaching using these two different chemical methods, as noted previously, are linked mostly to the effectiveness of the individual mill in recycling bleach plant effluent into an efficiently operated recovery system.[46] In fact, it has been observed that approximately one-third to one-half of the BOD and TSS pollution loadings from a kraft mill is due to unexpected or unanticipated spills.[47] The same is not necessarily true for air emissions. The kraft process accounts for 30 percent of the total common air contaminants emissions from the industry in Canada, and bleaching contributes to this overall problem.[48] But even here, the air emissions control efficiencies of the technologies available indicates that except for the odors (mainly associated with TRS gases) an acceptable level of air emission control can be achieved for most known air pollutants using existing technologies.[49] The pollution properties endogenous to a bleaching plant operation do not determine the total pollution loadings that actually result from this particular phase of production.

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[40] Ibid., p.25.

[41] Casey, op. cit., p.725.

[42] The Basic Technology, op. cit., p.75. Arthur C. Stern, Air Pollution, 3rd. ed., Vol. 4, Academic Press, London, 1977, p.688.

[43] Springer, op. cit., p.309 and p.314.

[44] It might even be concluded that bleaching makes a difference in the overall detectable environmental performance among mills employing variations of each of the conventional pulping processes, and that kraft bleaching is the most serious source of pollution among the pulping processes employed in the industry.

In this section, the documented pollution causing properties of two broad categories of pulp processing, five manufacturing areas, and one production phase are compared to the loadings (not including organochlorines) which are known to occur from these sources. On the basis of the observations made from these examinations, it would appear that the most widely used processes are not necessarily the most environmentally disruptive. The pollution loadings potential of particular manufacturing processing categories, areas, and phases do not necessarily determine the total of the actual loadings which occur from these sources. The most obvious reason for this discrepancy is that each different process, process area, and phase generates different types of pollutants. The motivation for developing pollution control technologies for each of these different manufacturing processes, areas, and phases varies, and consequently, the ability to control waste discharges differs. Therefore, it would appear that the pollution loadings caused by the industry are a function of both the pollution properties which are an implicit part of the process, and the ability and willingness of industry to adopt the necessary control technologies.

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[45] Casey, op. cit., pp.243-244.

[46] Springer, op. cit., pp.165-166.

[47] Ibid., p.127.

[48] Emissions and Trends of Common Air Contaminants in Canada: 1970 - 1980, Report EPS 7/AP/17, September 1986.

[49] Springer, op. cit., pp.309-358.

The Pollution Control Technologies Available and Their Application by Industry[50]

All pollution control measures used in pulp and paper manufacturing fall into one of two categories. The first encompasses those "in-plant" or "internal" control measures that are based on process or production phase modification. In-plant controls include the redesign, selection, or installation of operationally necessary equipment, which have known pollution reducing advantages. In some cases, it can be interpreted to include plant or facility modification and the dedication of mill employees for pollution control processes, either through the hiring of new personnel or the redeployment of existing staff. The second category includes all of those "out-of-plant" or "external" control measures that are not part of the on-going operational needs of a mill, but are separate measures specifically adopted to protect the environment. External controls include the introduction of special systems to the production stream which eliminate, reduce, or modify the inherent disruptive nature of the waste discharges so that they are less damaging to the receiving environment. It also includes the installation and adoption of environmental control systems that are separate (i.e. add-on or physically isolated) from the main production facility.[51]

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[50] The intention in this section is not to provide a detailed technical review of existing environmental control technology. This information is already available elsewhere. More modestly, it is to provide a general description that will allow a better overall understanding of those factors which most effect the environmental performance of the industry.

The in-plant control techniques that are technically feasible within the industry cover virtually every phase of production used in mill operations today. The effluent from the wood room can be treated to remove solids and be reused. In the dry debarking process, the bark can be burned in specially designed furnaces as a source of energy. Bark from wet debarking can be dewatered and also burned as a source of energy.

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[51] The commonly accepted distinction that is made between "external" and "internal" treatment and controls both in the literature and in practice undeniably depends on whether or not some part or all of the costs of the control measures can be recovered by the contribution that it makes to reducing production costs. The validity of this observation becomes apparent when it is seen that some of the treatment devices which are physically installed within a mill are also considered "external" treatments. See: Basic Technology, op. cit., p.144. Springer, op. cit., p.199. Edde, op. cit., p.3.

Solids in the form of slivers, knots, and unground pieces of wood from groundwood pulping can be screened, collected, and safely discarded. The technologies exist to contain for recovery most of the chemicals used in the pulping processes which are employed in a modern pulp mill.[52] It is not only possible to reuse white water in a paper making operation, but it is considered advantageous to do so in most cases.[53] Some are of the opinion that the fiber loss from a well run paper mill should not exceed one percent of total production.[54] It is possible to recycle the water in a bleach plant, so that the overall BOD loadings are reduced by 25 percent.[55] A shift from old to new bleaching processes also offers the potential for substantial environmental benefits. The use of oxygen bleaching has improved considerably since it was first developed and may in future make it possible to totally eliminate the use of chlorine.[56]

What could be considered the ultimate in internal technology in pulp manufacturing in kraft mills may be possible through what has been referred to as the "closed-mill approach".[57] The closed-mill concept was developed by a Canadian W.H. Rapson of the University of Toronto, and encompasses a combination of many of the known internal control techniques available. As is true of all other internal environmental safeguards, it too is predicated on the reduction of effluent through the more efficient use of the factor inputs, but it does have operating problems due to corrosion.

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[52] Springer, op. cit., p.152.

[53] Ibid., p.85. Casey, op. cit., p.1204.

[54] Springer, op. cit., p.99.

[55] Ibid., p.165.

[56] Ibid., p.171. Edde, op. cit., pp.35-37. Casey, op. cit., pp.1241-1242.

[57] Springer, op. cit., pp.128-129. Edde, op. cit., p.42. Casey, op. cit., pp.1229-1237.

The external pollution control measures used by the industry are usually employed to reduce or limit specific types of environmental pollutants.[58] The most widely used external control measure employed worldwide is the primary clarifier, which is used to remove TSS. Although the removal efficiency of clarifiers vary with the type of product produced, TSS reductions of 80 to 90 percent are normally achieved in most mills.[59] The use of clarifiers also can result in a very substantial reduction in BOD (claimed as high as 90 percent reductions in some paperboard mills).[60] Biological treatment is another frequently used external control measure, which may be applied as: oxidation basins, aerated stabilisation basins, activated sludge processes, or as land disposal.[61] The use of these technologies can reduce BOD by 70 to 95 percent.[62] These treatments also can reduce toxicity to fish.[63] Another external biological control method is the anaerobic treatment which reduces chemical oxygen demand (COD) loadings by 79 to 90 percent.[64] The use of anaerobic and aerobic treatments sequentially has resulted in the reduction of chlorates, and are felt to be effective in overcoming some of the limitations that are inherent in other biological treatments when they are used alone.[65] The efficiency of these external treatment techniques implies that when they are used in combination with the latest in-house waste control systems, it might be technically possible to protect the nation's water resources from most known environmentally disruptive waste substances generated in pulp and paper manufacturing.

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[58] While this is generally true, most out-of-plant environmental measures result in the reduction of some other disruptive materials besides those at which they are specifically directed.

[59] Springer, op. cit., p.200. Casey, op. cit., p.1250.

[60] Edde, op. cit., p.62.

[61] Springer, op. cit., p.214.

[62] The Basic Technology, op. cit., p.130. Environmental Considerations, op. cit., p.48.

[63] Toxicity of Effluence from Sulphite, op. cit., p.47.

[64] Springer, op. cit., p.260.

[65] Tage Berglund and Ulf Germgard, "Discharge of Chlorate Can Be Avoided By Using Aerated Lagoons", Svenskpapperstidning, No. 6, 1987, pp.36-39. Springer, op. cit., pp.259-260.

Like the effluent and solid waste treatment systems, air emission controls can be either internal or external. Internal or in-plant controls include such activities as reducing the overload conditions on a boiler, or converting to a cold blow process in a mill using a batch digester to reduce total reduced sulphur (TRS) emissions. It also encompasses lowering the sulfidity of the cooking liquor in a kraft mill to minimise TRS, and the air or steam stripping of condensates to remove odor and BOD.[66] External treatments include use of electrostatic precipitators (ESP), scrubbers, separators, and furnaces. Many of these external treatments are widely used throughout the world, and have been employed with good success to reduce air emissions. For example, dry scrubbers have been used with 95 to 98 percent efficiency by weight on hogged fuel boilers to reduce particulates. Dry scrubbers often achieve 99 percent particulate collection efficiency, and ESP's are generally considered to have 99 percent efficiency on kraft recovery boilers. TRS gases can be effectively reduced with 99 percent efficiency by black liquor oxidation.[67] It would appear that most known environmentally disruptive air emissions from pulp and paper mills can be controlled to acceptable levels (except perhaps TRS kraft mill emissions) with the use of available technologies.

Even though it is technically possible to protect both water and air from most known environmentally disruptive substances generated in pulp and paper manufacturing, it is not always economically feasible to do so. The estimated cost of capital expenditures for environmental controls to protect both air and water in 1985 dollars was estimated at between roughly twelve and fifteen percent of the total capital cost of building a new mill.[68] The costs associated with providing the necessary environmental controls grow as the technology improves and encompasses an ever increasing number of substances known to be threatening to the environment.[69] The cost of retrofitting pollution controls after a mill is built is very much greater than it would be if such controls were integrated in to the mill as it is being constructed. The older the mill, the more difficult and expensive it is to make modifications or to install new equipment. For example, the use of an aerated lagoon for biological treatment requires more space than is available on the land where many of Canada's older mills are located. The activated sludge alternative costs about twice as much to build and operate as does an aerated lagoon.[70] In one case, it is claimed that when a mill attempted to dispel community complaints about its air pollutants, it installed pollution control devises that cost thousands of dollars per ton of its pulping capacity, and it did not successfully render the mill odor free.[71] The implication is, that even though the technology is available whereby the waste from a pulp and paper mill can be controlled reasonably successfully, it is seldom economically possible to employ such technology to the limit of the potential of the various controls and treatment alternatives available. These basic realities suggest that the waste discharge from the pulp and paper industry must be controlled on the basis of the optimal solution for each individual mill, and not necessarily on the basis of the best technical solutions available.

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[66] Ibid., pp.350-351.

[67] For a general discussion of these external control systems see: Edde, op. cit., pp.121-162. Springer, op. cit., pp.335-352.

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[68] Ibid., p.357.

[69] The cost of applying the latest environmental controls to a new pulp mill in the late 1970's was estimated at three percent of the initial investment required to build a mill. See: Environmental Considerations, op. cit., p.11.

[70] Toxicity of Effluents from Sulphite, op. cit., p.45. Springer, op. cit., p.237. Casey, op. cit., p.1256.

[71] Springer, op. cit., p.358.

The Application of the Pollution Controls Available

The use and application of environmental control and treatment measures on the basis of the circumstances at each individual mill has considerable intuitive appeal. It is the approach most often advocated by industry representatives, and usually is supported by those who study and document pollution problems within the industry.[72] However, the application of control and treatment measures on the basis of the circumstances at individual mills does not imply that one-dimensional approaches are appropriate. The successful use of readily available prescriptions as automatic remedies to the pollution problems within the industry would depend on two conditions. First, it would depend on having full knowledge of the substances used, generated or inadvertently included in pulp and paper manufacturing, which are harmful to the environment. Second, it would be necessary to have the technical capacity to control all harmful substances with absolute certainty. Neither of these two conditions exist in the industry today, and they are not likely to exist in the future.

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[72] As will be noted later in this report, the survey of industry representatives that was undertaken in conjunction with this study revealed that most industry representatives advocate precisely this approach. Also see: Ibid., p.198. Edde, op. cit., p.3.

The ability to control the waste substances generated by pulp and paper manufacturing varies considerably according to the individual pollutant. Many commonly known contaminants can be controlled with a high degree of certainty. As indicated above, TSS can be effectively eliminated with a primary clarifier. Depending on the type of mill and the product produced, a certain amount of BOD can be removed with a clarifier. But BOD is controlled most efficiently by the use of a chemical recovery system, and can be virtually eliminated through the use of biological treatment.[73] However, as might be expected of the less centralised air emission control devices used in pulp and paper mills, not all environmentally disruptive air emissions can be controlled. The TRS gases which cause odors that are of mainly aesthetic concern, can not be totally eliminated effectively because of their generally low odor threshold. Colour is a water related disruptive encountered at many mills, which for the most part is considered a local nuisance or aesthetic problem, that cannot always be eliminated. Since colour often originates with lignin compounds that are not easily biodegradable, biological treatments sometimes contribute to this problem rather than providing a solution.[74] The waste substances which are difficult to control are not limited to what are considered the less serious pollutants.

The release of toxicants is considered by many as the most threatening waste resulting from the production of pulp and paper.

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[73] Although aerated lagoons and activated sludge treatments are both effective for removing BOD, the efficiency of aerated lagoons varies with temperature. It has been observed that a 10° C drop in temperature necessitates a thirty five percent increase in retention time to achieve the same level of BOD removal. Springer, op. cit., p.237. Casey, op. cit., p.1256.

[74] Springer, op. cit., p.182.

Toxicity can be reduced or even eliminated in some cases using a variety of processes such as carbons or membrane processes, electrochemical processes, or even biological treatment,[75] but there exists no single environmental control treatment that has consistently solved the toxicity problems associated with pulp and paper mills.[76] The use of biological treatment, particularly aerated lagoons, are often pointed to as the solution for eliminating toxicity. The use of these treatment systems has been successfully used for lowering toxicity to a tolerable level,[77] but even though there does not appear to be a correlation between BOD and toxicity,[78] the effectiveness of aerated lagoons to control toxicity appears to vary considerably according to temperature.[79] Therefore, even though it may be possible to reduce or even eliminate toxicity on the basis of controls and treatments specifically adopted to address the problem at an individual mill,[80] there is no single identifiable technology available to eliminate the dangers associated with toxicity from pulp and paper effluents.[81]

Aside from the problems associated with having the technical capacity to control all harmful substances with absolute certainty, there is as well the problem of identifying those specific substances that pose a threat to the environment. As society's understanding and ability to control harmful substances increases and improves over time, its ability to detect additional substances also increases. There are many instances where particular chemicals or compounds are used for many years, only to discover that these substances are a threat to the environment or even to the health and safety of those handling the materials. Examples of this include chloroflurocarbons which were widely used in spray products, but have been subsequently identified as being harmful to the ozone layer of the earth's atmosphere. In most instances, the difficulties associated with these substances stem mainly from inadequate knowledge about the seriousness of the threat posed by them once they are identified and found. The most recent example of this in the pulp and paper industry has to do with dioxins, which with reasonable certainty have been traced to kraft mill bleach plant operations.[82] Despite many statements of alarm made by some observers,[83] very little is known about the seriousness of the threat posed by dioxins. It is known that dioxins have been found in the effluent residuals from wood processing in many different countries,[84] but these same processing methods have been used for many years. The concentrations of dioxins in the effluent tested, are in the parts-per-quadrillion range of measurement. Measurements detecting chemical compounds in these concentrations were impossible until fairly recently. Therefore, dioxins similar to other problems of this nature, where overall impact is not fully understood, can only be addressed on an emergency basis if they are to be resolved in a manner that is in the best public interest.[85] Nonetheless, this example does point to the hazards associated with seeking, what are usually highly expensive all encompassing solutions to problems which are impossible to anticipate.

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[75] Ibid., pp.188-194. Toxicity of Effluents from Sulphite, op. cit., p.45.

[76] Ibid.

[77] Springer, op. cit., p.150.

[78] Casey, op. cit., p.730.

[79] Toxicity of Effluents from Sulphite, loc. cit.

[80] Report of Special Working Group, Water Pollution Problems of Pulp and Paper Industries in Finland and Sweden, Committee of the Gulf of Bothnia, Naturvardsverket Rapport 3348, May 1987, p.84. S. Schneiderman and Glen A. Allard, "Bio-Treatment Detoxifying Spent Liquor Effluents", Pulp and Paper Canada, Vol. 80, No. 10, October 1979, pp.43-48.

[81] Springer, op. cit., p.18.

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[82] Kimberley Noble, "Pulp, Paper Mills Linked to Dioxin Contamination", The Globe and Mail, Toronto, October 14 1987, p.B4.

[83] Glen Bohn, "Greenpeace Claim of Pulp-Mill Dioxin Alarms Oyster Farmers", The Vancouver Sun, January 7 1988, p.A11.

[84] Report of Special Working Group, op. cit., p.31. Donald Mackay, "On Low, Very Low, and Negligible Concentrations", Environmental Toxicology and Chemistry, Pergamon Journals Ltd., Vol. 7, 1988, pp.1-3.

The hazards of adopting a one-dimensional approach are exacerbated substantially by the very large investment of money, time, and effort that some environmental control mechanisms require. The installation of an external treatment system to address a BOD problem in an inlet or waterway that eventually fails to eliminate oxygen deficiency, because of either poor natural flushing or inadequate flow conditions, is a very expensive way to learn of the unanticipated inadequacies of the most apparent control mechanisms available. When such measures fail to resolve the problem as intended, the credibility of those advocating environmental measures is brought into question. Perhaps even more importantly, such failures will detract from the willingness of those in position to decide on adopting similar safeguards in future. Depending on the situation at an individual mill, it may contribute to financial difficulties that either detract from ongoing environmental safeguards or prohibit the use of additional measures if subsequently required. This is not to suggest that very large investments may not be absolutely necessary in such situations. It is to suggest that the problems which can result from well-meaning attempts to resolve complex environmental issues using all encompassing single-solution approaches might both fail to accomplish what is intended, and result in foreclosing future options.

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[85] This is an international problem that is being examined by health and environmental authorities throughout the world. In Canada, the Department of Environment, Health and Welfare, the Department of Fisheries and Oceans, and the Canadian Pulp and Paper Association are cooperating in undertaking what are sometimes independent investigations into the presence of dioxins in pulp and paper manufacturing.

Inadequacies in the present state of knowledge about harmful waste substances is not confined simply to identifying such substances, but as implied above, requires an understanding about the impact that particular compounds have on life-systems. Both treated and untreated substances from mills are deliberately and inadvertently discharged into the atmosphere and water, where they are intended to assimilate through dilution, transformation, and degradation. The tolerance of receiving natural systems to absorb and disperse waste materials differs according to location. It varies according to the number of other sources discharging similar materials in the same area. It also varies with differences in the inherent assimilative capacities and the persistence of particular compounds. As a result, it is difficult to gather and assemble sufficient information to provide an adequate data base for proper scientific analysis. It is difficult to collect and have access to the knowledge necessary to properly analyse the data once gathered and compiled to measure and predict environmental impact. Yet the determination of the risk that is imposed on society as a result of using, producing, or accidentally including specific substances in manufacturing processes sometimes depends directly on having these types of information and knowledge.

The complexities involved in establishing the degree of impact and risk is furthered by the fact that the earth's crust and atmosphere is comprised of a vast number of elements, compounds, and mixtures. Some of these substances are natural and some are man-made. Most of them are harmful if present in sufficient abundance within particular locales. As technology changes, there is no doubt that additional chemicals will be found in locations where they are not previously known to exist. Some will prove disruptive, and perhaps dangerous, and some will prove to be harmless. It is impossible to protect the environment and life-systems that will depend on the earth's environment, from all known and unknown chemicals. It is not possible to know the source of all chemical compounds or elements that might be found present in the vicinity of a mill with certainty. There is no way to prevent all potentially harmful substances from leaving an individual manufacturing operation with absolute certainty. Thus, the environmental protection strategies adopted by individual mills should include within them both technical solutions (internal controls) that limit the amount of waste leaving the mill and biological treatments (external controls) to help nature dissipate the harmful properties, which are an inevitable part of most residual materials. The use of both internal and external pollution control measures in combination provide the greater possibility to develop a strategy within the economic capability of the individual facility without foreclosing future options.[86]

The use and application of both internal and external control measures on the basis of the requirements at individual mills allow operators to avoid adopting control measures that are unnecessary to the circumstances of their individual facility. It permits the use of the best known and available technology control measures to be used in a manner which provides the most effective protection available at minimal possible cost.[87] This does not necessarily imply that all the environmental safeguards required to reduce pollution to acceptable levels will be appropriate to the economic circumstances of each individual mill. However, when biological impact assessments are used in conjunction with the blended use of both internal and external controls, it becomes possible to establish priorities for the installation of such controls on the basis of environmental necessity, rather than on the contribution that such measurements make to reducing production costs.[88]

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[86] Springer, op. cit., p.198 and p.60.

[87] Ibid., pp.59-61. Edde, op. cit., p.3.

The Use of Pollution Control Technologies at Individual Mills

The same motivating factors that influence the industry as a whole, affect the attitude and behaviour of managers of individual mills. The managers of individual mills are expected to produce products that possess the inherent characteristics preferred by consumers. They must produce products at a low enough cost to generate a profit so that the owners will receive adequate return on their investment. Nonetheless, there are subtle differences which distinguish the behaviour of individual companies, firms, or mills from that of the industry. Even though both industry and individual industry components will tend to limit their pollution control efforts to those areas which contribute most to reducing the costs of production, the end results will not necessarily be the same. Industry efforts will tend to focus on technologies that can be applied in pulp and paper manufacturing. Some of these technologies might be applied in other industries, but the raison d'etre for these activities will be to develop technologies that can be utilised within the industry. In contrast, the focus of the individual components of the industry will not necessarily be toward developing and using technologies to help the industry. The individual company or mill can be expected to direct their efforts to those specific mechanisms, which give them an advantage (cost of production) over the competition. Therefore, it can be readily predicted that industry efforts, when taken collectively, will inevitably result in the introduction of new and more effective environmental control technologies. Whether or not these technologies are willingly adopted usually will depend on the overall advantage of such measurements to the individual company or mill.

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[88] D.W. Schindler, "Detecting Ecosystem Responses to Anthropogenic Stress", Canadian Journal of Fisheries and Aquatic Science, Vol. 44, (Suppl. 1), 1987, pp.6-25. J.D. Weinbauer, et al., "Receiving Stream Fisheries Studies Relative to Secondary Treated Pulp and Paper Mill Effluents", TAPPI, Vol. 63, No. 10, 1980, pp.121-125.

The technical and economic realities of implementing environmental controls practically always necessitates the combined use of both external and internal treatments. However, when left to their own devices, most companies or mills will resist external treatments in favour of internal controls. While the environmental advantages for using only internal controls are debatable, the financial attractiveness to the individual company or mill are quite clear. External treatments are in fact a direct additional burden on the manufacturing facilities, that do not contribute to operational productivity. Since external treatment is an "add-on" and does not contribute to productivity, it almost never yields any return on investment. They are in fact capital intensive developments, which practically always add to the ongoing operating costs of the plant or facility.[89] The very onerous nature of the additional expenditures associated with external treatments, understandably, causes many companies and mills to resist the use of these treatments.

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[89] Springer, op. cit., p.199.

The essence of internal controls is to reduce the materials input requirements for pulp and paper manufacturing. Internal controls are in-plant modifications, which are integrated into the manufacturing process of a mill. They represent the only mechanism whereby the adoption of environmental protection safeguards can improve the productive efficiency of a facility so that it yields an economic return on investment.[90] Although such systems are more complex than external treatments to install and operate, it is possible to design internal controls so that the amount of capital investment is small or even nonexistent, and no additional operating costs are incurred.[91] The relatively smaller initial investment requirements combined with the operating cost savings which are practically always achieved through the use of internal controls, usually makes them a more attractive alternative to individual companies and mills than external treatment. This is especially so, when one type of treatment is perceived as an alternative to the other.

The advantages associated with pollution controls are revealed by the information contained in Table 2:6, which shows the reported changes in processes, the visible improvements, and the level of cost recovery associated with environmental safeguards adopted for individual mills in Canada as of January 1987. According to this information, all of the 50 mills included in the survey made some internal process modifications for the purpose of protecting the environment. These same mills

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[90] Loc. cit.
[91] Loc. cit.

TABLE 2:6

NUMBER AND PERCENTAGE[1] OF MILLS IN SURVEY THAT REPORT CHANGES IN OPERATIONAL PROCESSES WHICH HAVE RESULTED IN VISIBLE ENVIRONMENTAL IMPROVEMENT AND THE FINANCIAL IMPACT OF THE INVESTMENT[2] - 1987

	Mills Reporting Changes in Process of Operations for Environmental Reasons		Mills That Claim to Have Achieved Visible Environmental Improvements in Air or Water Quality		Mills That Report Having Recovered Total Cost of Environmental Improvements Taken		Mills That Report Having Partial Cost Recovery of The Environmental Improvements Taken		Mills That Report Having No Cost Savings From The Environment Improvements Taken	
	#	%	#	%	#	%	#	%	#	%
British Columbia	11	100.0	9	81.8	0	0	9	81.8	2	18.2
Ontario	12	100.0	12	100.0	2	16.7	7	58.3	3	25.0
Quebec	17	100.0	16	94.1	0	0	13	76.5	6	35.3
Atlantic/ Prairies	10	100.0	10	100.0	1	10.0	6	60.0	3	30.0
Total All Canada	50	100.0	47	94.0	3	6.0	33	66.0	14	28.0

[1] The number of mills represented in a particular category as a percentage of the total included in survey.

[2] The total number of mills included in the financial categories may exceed the total number of mills included in survey because mill officials may have given more than one answer to reflect the different results from different environmental investments.

Source: Industry and Provincial Agency Survey, 1987.

report, that in most all cases, some visible environmental improvements resulted from the environmental safeguards adopted. Six percent indicated that they recovered the total of the cost of the improvements that were undertaken. Sixty-six percent indicated partial recovery of cost, and fourteen percent indicated no cost savings. The difference between visible improvements and no visible improvements might be explained in terms of whether or not the mill used only internal controls or a combination of both internal and external treatments. Those mills that reported no visible improvement, without exception, did not employ external treatments. The difference between those reporting partial or total cost recovery and those reporting no cost recovery, almost always depended on the balance between external and internal controls as employed at the individual mill.

The adoption of internal environmental controls at a mill does not necessarily automatically result in production savings; it does not mean that expenditures on internal controls are always an economically desirable investment. For example, the industry has made very substantial improvements in chemical recovery technology over the years. With these improvements and the high cost of chemicals and energy, it could be anticipated that there would be a very substantial economic benefit to adopting internal systems for liquor recovery. In many cases this is true.[92] However for certain processes, the use of a chemical recovery system cannot be economically justified. The calcium-based sulphite process does not yield sufficient liquor to justify the installation of a chemical recovery system.[93] In other situations, the installation of a liquor recovery system may result in production savings, but the economic advantages are not as attractive as they would be if the same amount of money were directed into other investments. In the majority of these cases, the decision on whether to install a chemical recovery system would depend on individual circumstances.

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[92] Every kraft mill in North America, and perhaps the world, has a liquor recovery system. The obvious reason for this is the very substantial economic benefits that accrue to the mill from installation of these systems.

The importance of individual circumstances in influencing the decisions on providing internal environmental controls is most clearly illustrated by using another example involving the installation of a liquor recovery system. In one Eastern Canadian sulphite ammonium-based mill it was determined that the installation of a chemical recovery system would result in a cost-of-production saving for energy of approximately $4 million annually.[94] When the value of this saving is calculated using a ten percent discount rate, it can be estimated that the present value of the return from these energy cost reductions would be in excess of $36 million over a 25 year period. An economic return of this size for installing a $35 million recovery system does not, unto itself render this an attractive investment. It could be safely predicted that most companies or mills would resist such an investment, if it were being assessed solely on the basis of energy savings. The commitment of funds in the amount usually necessary to implement internal pollution controls, seldom depend on a single consideration. Even though the mill used in this example will recover their initial investment over a period of time, a great deal would depend on the economic climate in which the mill operates, the financial well-being of the firm, the phase of the business cycle, and the investment alternatives available. In other words, when there is no absolute obligation on the company or mill to adopt environmental safeguards, and the economic advantages and disadvantages of the investment cannot be predicted with certainty (which is the case in most situations), the choice on whether or not to undertake such an expenditure practically always is at the discretion of company and mill officials.

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[93] Springer, op. cit., p.20.

[94] Roman Hohol, "Environmental Projects Saves Energy as Well", Canadian Pulp and Paper Industry, November 1981, pp.49-53.

When the economic advantages of adopting pollution control measures are unclear, and the decision for implementing the necessary controls are left to the discretion of industry officials, then much will depend on the firm's policy. If the company or mill has an environmental policy, it could be anticipated that the decision will conform to the dictates of that policy. If an environmental policy has not been established, then the present views of those making the decision will often prevail. In this regard, it should be noted that there often exist what have been referred to as perverse incentives for not adopting environmental safeguards.[95] For example, an individual company or mill might decide to delay abatement action in hope of the development of new technologies. They may decide not to make the necessary modifications simply because they have an aversion to using new technologies.[96] They may choose to delay the commitment of funds for environmental controls to avoid making unpopular decisions (leaving it to successors), which might reduce stockholders' dividends. Under the circumstances described above, where the energy savings are reasonably certain and other economic conditions are uncertain, the choice will often depend on the evidence available to support the need for pollution controls to protect the receiving environment. There is little question that individual companies and mills are more likely to undertake the commitment to protect the environment when scientifically valid evidence on the biological impact of a mill's operation is available.[97]

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[95] James B. Stephenson, "Pulp Control in the Pulp and Paper Industry", The Practical Application of Economic Incentives to the Control of Pollution, British Columbia Institute for Economic Policy Analysis, University of British Columbia Press, Vancouver, 1977, p.187.

[96] "Canadian Companies Slow to Grasp New Technology", Pulp and Paper Journal, Vol. 40, No. 9, November 1987, p.15.

The advantages of using both external and internal controls become more apparent to the companies and mills, when the obligations for environmental controls are firmly established. In situations where a company or mill has a great deal of discretion about when it has to achieve certain environmental standards, the choice of whether or not to install environmental safeguards will practically always depend on economic merit. As described above, where the economic merit of an environmental decision is unclear, the choice will depend on the views of those making the decision. However, when the standards are clearly established, and the time-frame for meeting the standards are specified, the choice available to the company or mill changes. It is no longer a question of whether or not the required safeguards will be adopted, but of how best to achieve the necessary safeguards in a manner that best serves the interests of the firm. Mills that are being built, or under major modification, will almost certainly find it advantageous to incorporate the best in available technology during construction. The installation of internal controls at the time of construction both reduces the cost of adopting such measures and the total loadings generated in the mill. With less loadings, smaller external treatment facilities are required. Not only does this decrease the initial capital investment requirements, but it also reduces the cost of updating pollution control facilities in order to accommodate future expansion. In short, when external treatments are used to supplement internal control measurements, it can reduce the probability of accidental spills, and increases the options available to deal with unforeseen future environmental emergencies.

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[97] J.N. Fisher, "Employing Acute and Subacute Toxicity Measurements in On-site Biomonitoring Studies", TAPPI, November 1982, pp.89-91.

Under circumstances where the environmental obligations are firmly in place, the use of both internal and external controls also is advantageous for existing or older mills, when there is sufficient space available to install external treatment facilities. Existing mills often will opt for external treatments because the technology has already been developed, and the use of these treatments do not interfere with the manufacturing process.[98] Once the external treatments have been integrated into the pulp operation, it then makes sense to begin to refine internal processes to both reduce the treatment loadings (and therefore the costs of operating the external treatment facilities), and to lower the factor input requirements for production. Similar to the situation in new mills, the staged introduction of in-plant modifications to supplement external treatments in existing mills would reduce the cost of future expansion, and add to the ability to address unforeseen future environmental requirements at minimal cost.

Acceptance of the need for the combined use of both external and internal controls ultimately depends on the obligation of the individual company or mill to meet appropriate environmental standards. However, the willingness or ability of individual mills to meet prescribed environmental standards will vary. When the environmental standards are not appropriate to the financial circumstances of the company or mill, closure may ultimately result. However, as will be discussed later, only infrequently will a mill close down its operations because of environmental requirements, if it is otherwise economically sound. Even an economically marginal operation often has choices available to avoid closure. The installation of environmental safeguards can be delayed so that expenditures on controls are phased in as an ongoing part of their capital expenditure program.[99] An integrated mill might choose to close down its pulp mill and purchase market pulp for its needs.[100] The perverse incentives that exist for a mill to delay adopting the necessary controls, may lead to unjustified resistance to pollution controls on the part of individual companies and mills. Nonetheless, it should be recognised that all incentives for adopting environmental safeguards are not necessarily negative. Neither are they necessarily expensive.

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[98] Springer, op. cit., p.199.

The attitude of the general public towards the environment has changed substantially over the years, and with this there has developed what might be referred to as an "environmental ethic". This has resulted in consumer concern about the products they purchase, and the image of the organisations that make these products. Pulp and paper producers, like other manufacturers, wish to be perceived as good corporate citizens, which has a value that frequently is recognised on the balance sheet in what is commonly referred to as "goodwill". Goodwill often impacts on the overall price that company shares sell for in the market.[101] More and more, as environmental consciousness of the public continues to grow, the overall worth of the firms will be affected by the efforts made to reduce pollution. Although difficult to document, there are a growing number of pulp and paper companies within Canada that carry out conservation and environmental programs for the express purpose of maintaining or improving public image.[102] Some large companies advertise their efforts in the popular media,[103] others simply wish to avoid "bad press" by ensuring that the firm's name is not linked to any "spills" or other incidents which could be viewed as having lack of regard for public interest. Regardless of whether such efforts are simply public relation programs or actual attempts to improve the environment, they represent a significant commitment of resources. The value of such commitments can easily be destroyed as a result of a single incident which results in environmental damage that captures media attention.[104]

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[99] As will be discussed later in this report, all mills operating in the pulp and paper industry have to make investments in their facilities to remain competitive in the rapidly changing international pulp and paper market.

[100] Springer, op. cit., p.325.

Another important economic and social issue which has direct bearing on the willingness of companies or mills to adopt environmental safeguards is the attractiveness of areas immediately adjacent to pulp and paper mill location. Some of Canada's pulp and paper mills are located in urban areas, where the amount of waste being discharged from a mill is under constant scrutiny. It is generally accepted that the tolerance of the public toward industrial pollution varies somewhat according to region. Nonetheless, the citizens of most areas recognise that the quality of their lives are affected by the state of the environment where they live. If the environment is poor, then the attractiveness of the area as a place to live suffers. If the attractiveness of an area as a place to live suffers, the amount of investment that takes place within the area also suffers. When investment is low, the amount of services available are reduced, which in turn determines the size of the population and the economic activity which takes place within the region.[105] It is in fact a vicious circle. The very qualities which most citizens consider necessary for their comfort, and the comfort of their families, ultimately determine the value of local property. Most people and service organisations are generally aware of these interrelationships, and as a result can place a considerable amount of pressure on local industry to adopt environmental safeguards.[106] Thus, the amount of investment that takes place at manufacturing facilities located in urban areas is often dictated by perceptions about what is considered an attractive environment. This in itself is a major incentive for pulp and paper mills, and other manufacturers, to make a certain minimal amount of investment on environmental safeguards.

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[101] This was discussed in a recent article in The Vancouver Sun, where it was noted that there is a growing trend among investors to avoid buying shares in companies with poor environmental records. See: "Ethical Investing: It's all a Matter of Conscience", The Vancouver Sun, March 7 1988, p.B4.

[102] During a recent meeting with a senior officer of an Eastern mill, the company representative pointed with pride to the environmental efforts made by the company's mills in reducing pollution for reasons that relate mainly to public interest. This same officer noted that his company was a good corporate citizen, and the environmental performance of his company was tangible evidence of this fact.

[103] MacMillan Bloedel has an advertising program on television, that describes the company's efforts to protect and maintain the existing forest base through a seedling planting program.

[104] "Lumber Sector Told to Improve Image", The Vancouver Sun, February 15 1988, p.E4.

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[105] William F. Sinclair, The Socio-Economic Importance of Maintaining the Quality of Recreational Resources in Northern British Columbia, Fisheries and Marine Service, Kitimat-Stakine Regional District, PAC/T-74-10, NOB/ECON 5-74, June 1974, pp.125-126.

[106] Glenn Bohn, "Proposed Canfor Pulp Mill Attract Town's Opposition", The Vancouver Sun, February 17 1988, p.E8.

The importance of public pressure in encouraging pulp and paper mills to adopt environmental safeguards is important in urban areas, but it is even more important to a company or mill located in a rural location. A large portion of the pulp and paper mills in Canada are located in remote or rural areas where the amenities available are an important factor in determining the size and stability of the resident population. Those that choose to live in rural areas usually have a preference for the amenities of the outdoors. The age distribution of those who actually establish permanent residence in rural settings is largely determined by the availability of the services available (e.g. schools, medical services, transportation). Older or retired residents add to the disposable income available to support local services. That segment of the population that has younger school-aged children, usually are at a stage of life where commitment to career and to earning regular income are at the highest. Therefore, the more attractive the surrounding environment and the more services available, the less the cost of attracting and maintaining a labour-force commensurate with the attributes and skills required by the mills located in rural locations.

The cost of attracting employees to locations where there is a shortage of amenities should not be underestimated. Even under circumstances where a mill is willing to pay premium salaries, supply housing, or provide transportation to reduce family separation, a shortage of amenities will lead to labour-force turnover (especially during buoyant economic periods). The cost of training and providing younger employees with the experience to successfully compete for alternative employment opportunities in more competitive situations, can be both expensive and disruptive to a mill's operations. Since many pulp and paper mills are located in communities where conditions at the mill play a very significant role in the quality of local life, decisions on environmental safeguards directly impact on the operating costs at a mill by making it more difficult and expensive to acquire and maintain workers with the appropriate training and skills.

Changing public attitudes towards the environment has altered the perception of the general population about industrial pollution, but also it impacts on the expectations and demands of workers. Up until fairly recent times, most people have been willing to accept some environmental deterioration in exchange for a higher standard of living and an abundance of consumer goods. However, with greater environmental awareness many are skeptical about the trade-offs involved in deciding on their individual tolerance for unpleasant odors, fumes, dust, corrosive gases, and water effluents.[107] This new awareness often results in organised protests by residents living in areas in proximity to the mill for compensation for the economic costs imposed on them due to soiled clothing, erosion of metals, and the deterioration of exterior surfaces.[108] It also has resulted in organised labour making greater demands for offsetting compensation for what they consider inferior working conditions.[109]

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[107] Robert Plaskin, "Protecting Canada's Environment More Crucial Than Jobs, Poll Says", The Globe and Mail, November 19 1986, P.A1.

[108] In single industry or company communities, the residents living in the vicinity of the mill are comprised mainly of employees and their families.

[109] Glenn Bohn, "Dumping Probe Sought", The Vancouver Sun, November 27 1987, p.B1.

Even though in the vast majority of cases, deterioration in the receiving environment does not result in a direct health or safety hazard to workers, it has resulted in many mills providing workers with sheltered parking facilities and car washes to remove dust particles or corrosive materials from painted surfaces. The modern worker and his family no longer feels that having a clean environment and a high level of material goods availability is impossible, and there is an ever increasing demand on industry to supply stable employment, good income, along with a clean working and living environment.

Even though the attitude of mill workers and their families often influence the decisions of management to install environmental safeguards, they are not necessarily the only or most important attitude-related reason for improving pollution abatement performance at a mill. Many pulp and paper companies in Canada have clearly established policies which pertain to the environmental safeguards required in their manufacturing operations. Such policies usually include within them a statement about the level of commitment of the company to protecting the environment. The specific activities that are required as part of the duties necessary to be in compliance with the policy often includes employee training and spill reporting procedures. Mill employees within each department are required to include information on effluent losses as part of their regular production reports. Such efforts not only help identify those phases of a mill's operation which generate the most wastes, but also help identify the maintenance requirements within the plant. A well established set of operational pollution control procedures gives employees an understanding of the priority that management places on environmental controls. It gives workers a sense of pride about their workplace, and about the level of concern that management has for the welfare of employees and the employees' families. Company environmental policies can be used to supplement investments on in-plant modifications and treatment facilities to improve control efficiencies. When the attitude of company managers is reflected in a well documented environmental policy that outlines the procedures to be undertaken, as an integral part of the overall operation, the amount of waste discharge and risk of spill can be reduced at comparatively modest cost to an organisation.

Environmental Protection and the Economic Implications on Industry and Society

Within any system designed to systematically address the environmental problems from an industry as technically, economically, and locationally diverse as pulp and paper manufacturing, there remains tremendous scope for disparity. Not insignificant in this regard, is the fact that Canada encompasses a tremendous land mass (approximately 9.2 million km^2), which includes numerous distinct geophysical regions. Bordered by oceans on three sides and with thousands of lakes, Canada has an abundance of salt and fresh water, numerous climatic zones, and geological formations which together form diverse and interrelated systems that support a myriad of different forms of life. These systems, and the forms of life which depend on them, vary both with respect to the contribution that is made to human existence, and in sensitivity to human activities. Some forms of life are of immense commercial, recreational, and subsistence value. Some are extremely fragile and suffer damages as a result of the slightest infringement on the environment in which they depend. The diverse nature of these systems, and their dependent life forms, vary according to region and location. Consequently, the tolerance of these ecosystems to absorb and assimilate residual wastes, including pulp and paper generated wastes, varies substantially according to location.

These very substantial variations in the assimilative capacity of different receiving environments are made more complicated by the geographic distribution of the resources on which the industry depends. Canada's productive forests and surface waters cover more than one-half, or about 4.6 million square kilometers, of the nations total area.[110] The single most important element necessary for the production of pulp is wood fiber. The industry also uses vast amounts of water both as an element in its production processes and as a method for dispersing of its waste materials. The widespread presence of these resources is a major reason for its success, and for its presence (either as a manufacturing facility or a wood harvest operation) on practically all of Canada's river basins, estuaries, and major waterways. It is a major reason why the collective impact of the industry on the water resources can result in the transport of waste substances from one region to another and across international boundaries. It also can result in the deterioration of domestic drinking water and in the degradation of the quality of wildlife habitat. The often very subtle nature of these impacts are such, that many Canadians are not always fully aware of the scope of the water-related problems which can be caused by the industry, if left unchecked. Nonetheless, it is a problem that has both national and regional implications.

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[110] Canada Water Yearbook, Environment Canada, Hignell Printing Ltd., Ottawa, 1975, p.98. G.M. Bonnor, Canada's Forest Inventory 1981, Forestry Statistics and Systems Branch CFS, 1982.

In contrast to the situation in water, most Canadians are aware of the impact that pulp and paper manufacturing can have on air. However they often tend to overestimate the effect of pulp and paper mill emissions into the atmosphere. The perception that Canadians have about the industry's impact on air quality is usually formulated on the basis of personal experience. As a result of the widespread use of kraft pulping processes, the first encounter of most Canadians with the environmental disruptions caused by the industry is in the form of the obnoxious and distinctly unpleasant odors caused by TRS emissions. Because the odors caused by TRS can be detected from 50 to 100 kilometers from a mill,[111] and many kraft mills are located within commuting distance of urban areas, a large number of Canadians are under the impression that air emissions from pulp mills are a major pollution problem. While not discounting the discomfort of these emissions to individuals, the fact is that TRS and other air emissions from the industry represent only a small portion of the total common air contaminants discharged into the nation's atmosphere. As such, they do not add significantly to the total environmental problems in Canada from a loadings point of view. Depending on atmospheric conditions within limited geographic locations and the processes used, air emissions from pulp mills can cause aesthetic problems which impact on the lifestyles and economic well-being of those living in certain local areas.

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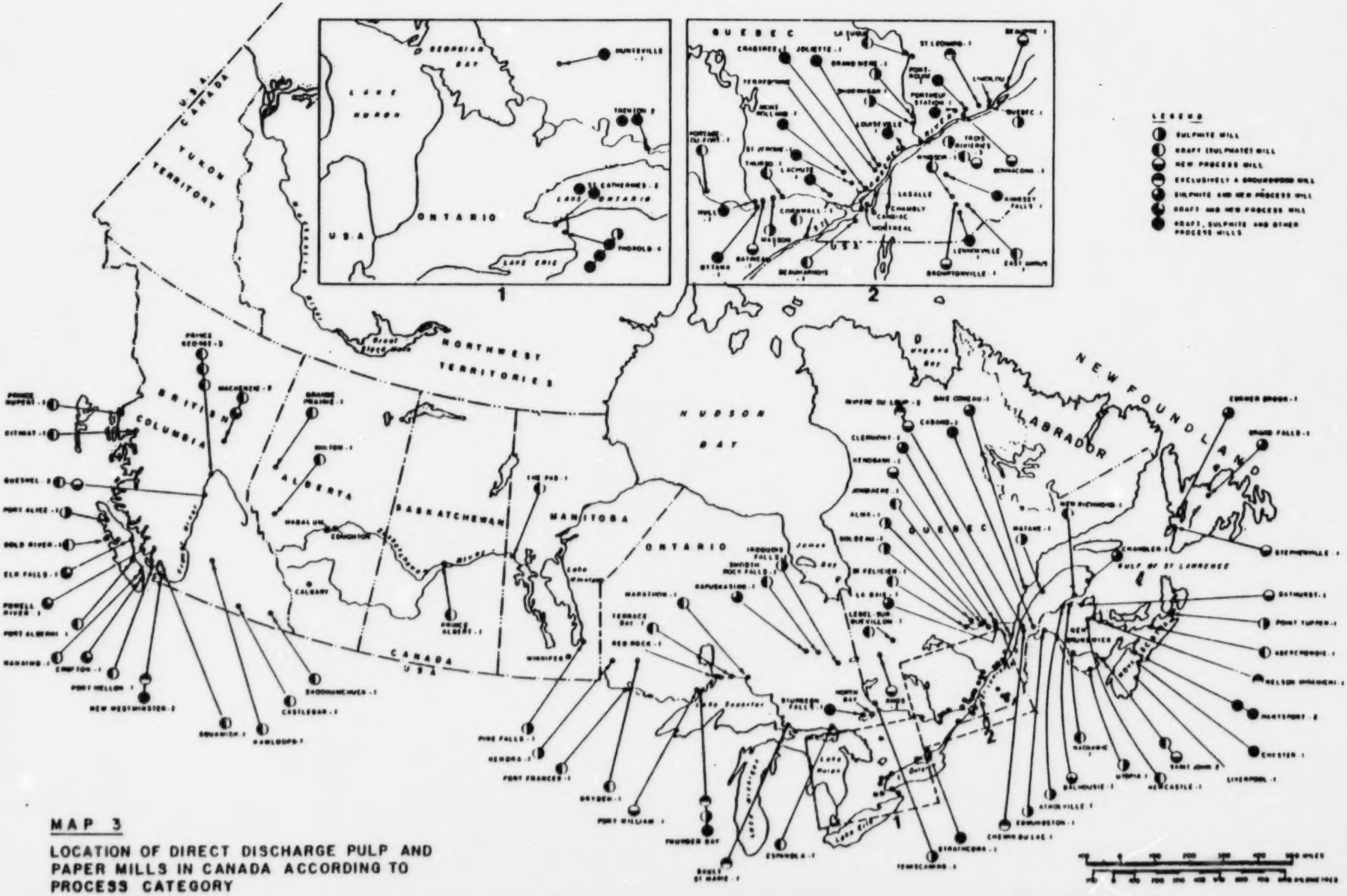
[111] Environmental Considerations, op. cit., p.55.

Therefore, except for the need to monitor mill air emissions as part of an overall effort to remain aware of ambient air quality nation-wide, it is mainly a regional or local problem with comparatively small national implications.

The complexities which result from the different circumstances of air and water are exacerbated by the structure and distribution of the industry within Canada. This is at least partially revealed by a comparison of the two different sets of information presented in Map 3 and Table 2:7. The information contained in Map 3 shows the location of direct discharge mills in Canada during 1987 according to process category. Table 2:7 contains data on the daily pulp and paper production in Canada by region for 1985. According to these data, most of Canada's sulphite mills are located in Quebec, where 48 percent of Canada's total daily production of newsprint takes place. The high volume kraft production mills are mainly located in Western Canada, where more than half of the nation's marketable pulp and kraft paper (54 percent) are manufactured. Those mills using kraft, sulphite, and other processes together (mixed processes and processing) are primarily located in Ontario and Quebec, with a few in the Maritimes and British Columbia. When these data are viewed in the context of the information presented in earlier sections of this Chapter, which pointed to the difficulties associated with implementing environmental controls for certain processes and phases of manufacturing, the potential for disparity in environmental performance among regions becomes apparent.

Other information which reveals the potential for environmental



LEGEND
● SULPHITE MILL
● KRAFT (SULPHATE) MILL
● NEW PROCESS MILL
● EXCLUSIVELY A GROUNDWOOD MILL
● SULPHITE AND NEW PROCESS MILL
● KRAFT AND NEW PROCESS MILL
● KRAFT, SULPHITE AND OTHER PROCESS MILLS
1
2
QUEBEC
ONTARIO
LAKE HURON
LAKE ONTARIO
LAKE ERIE
GEORGIAN BAY
U.S.A.
HUNTSVILLE
TRENTON
ST CATHERINES
THOROLD
LA TUQUE
BEAUPRE
ST LEONARD
CRABTREE
JOLIETTE
GRAND MERE
QUEBEC
TROIS RIVIERES
CAP DE LA MADELEINE
LOUISEVILLE
ST JEROME
LACHUTE
HULL
GATINEAU
OTTAWA
CORNWALL
BEAUHARNOIS
MONTREAL
CANDIAC
CHAMBLY
LASALLE
WINDSOR
EAST ANGUS
BROMPTONVILLE
LENNOXVILLE
KINGSEY FALLS
DONNACONA
YUKON TERRITORY
U.S.A.
CANADA
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
HUDSON BAY
LABRADOR
NEWFOUNDLAND
GULF OF ST LAWRENCE
NEW BRUNSWICK
NOVA SCOTIA
CANADA
U.S.A.
PRINCE RUPERT
KITIMAT
PRINCE GEORGE
MACKENZIE
QUESNEL
PORT ALICE
GOLD RIVER
ELK FALLS
POWELL RIVER
PORT ALBERNI
NANAIMO
CROFTON
PORT MELLON
NEW WESTMINSTER
SQUAMISH
KAMLOOPS
CASTLEGAR
SKOOKUMCHUCK
GRANDE PRAIRIE
HINTON
EDMONTON
CALGARY
THE PAS
PRINCE ALBERT
WINNIPEG
PINE FALLS
KENORA
FORT FRANCES
DRYDEN
FORT WILLIAM
THUNDER BAY
RED ROCK
TERRACE BAY
MARATHON
KAPUSKASING
SMOOTH ROCK FALLS
IROQUOIS FALLS
STURGEON FALLS
NORTH BAY
ESPANOLA
SAULT ST MARIE
TEMISCAMING
STRATHCONA
RIVIERE DU LOUP
BAIE COMEAU
CLERMONT
KENOGAMI
JONQUIERE
ALMA
DOLBEAU
ST FELICIEN
LA BAIE
LEBEL SUR QUEVILLON
MATANE
NEW RICHMOND
CHANDLER
CORNER BROOK
GRAND FALLS
STEPHENVILLE
BATHURST
POINT TUPPER
ABERCROMBIE
NELSON MIRAMICHI
HANTSPORT
CHESTER
LIVERPOOL
SAINT JOHN
NEWCASTLE
DALHOUSIE
ATHOLVILLE
EDMUNDSTON
CHEMIN DU LAC
MILES
KILOMETRES

MAP 3

LOCATION OF DIRECT DISCHARGE PULP AND PAPER MILLS IN CANADA ACCORDING TO PROCESS CATEGORY

TABLE 2:7

TOTAL DAILY PULP AND PAPER PRODUCTION IN CANADA BY REGION IN TONNES PER DAY 1985

	Newsprint		Marketable Pulp And Kraft Paper		Other Pulp And Paper Product	
	#	%	#	%	#	%
Atlantic	4,590	15.4	3,757	13.3	8,915	13.0
Quebec	14,280	48.0	5,105	18.0	22,978	33.5
Ontario	5,490	18.5	4,140	14.7	14,570	21.2
Prairie Provinces	509	1.7	2,342	8.3	2,851	4.2
British Columbia	4,867	16.4	12,914	45.7	19,234	28.1
	29,736	100.0	28,258	100.0	68,548	100.0

Source: Information gathered by Environment Canada in cooperation with Canadian Pulp and Paper Association and individual company officials.

performance disparities among producers is contained in Table 2:8. Table 2:8 shows the number and percentage of direct discharge mills operating in 1987, that were in production during some part of each of four twenty year periods 1900 to 1981. According to this information, more than 21 percent of the mills located in Ontario and Quebec during 1987, operated prior to 1900. In fact, very nearly 86 percent of Ontario mills and 75 percent of Quebec mills were in operation prior to the end of World War II. This contrasts substantially with the situation in Western Canada, where only a limited number of the mills operated prior to 1941. While recognising that the age of mill structure does not necessarily provide an accurate representation of the age of the manufacturing facilities (which undoubtedly would have been updated on a number of occasions), it does point to the potential existence of differences in the capacity to adopt environmental safeguards amongst regions. As noted previously, older mills often do not have the space to install external treatments. Internal control modifications are more complex and more difficult to integrate into the manufacturing processes of older mills.

When this information is viewed in light of the variations in the technical and economic feasibility of controlling wastes among different processes, the potential for regional disparities become clear. When the technical and economic feasibilities are linked to the complex and profound reasoning which often determines the willingness of a company or mill to adopt environmental controls, the potential for environmental disparity becomes even more clear. However, when all of these factors are taken into account, and reflected on in terms of the locational variations

TABLE 2:8

NUMBER AND PERCENTAGE OF DIRECT DISCHARGE MILLS OPERATING IN 1987 THAT OPERATED DURING SOME PART OF EACH TWENTY YEAR PERIOD 1900 - 1981

	British Columbia		Prairies		Ontario		Quebec		Atlantic	
	#	%	#	%	#	%	#	%	#	%
Prior to 1900	0	0	0	0	6	21.4	10	21.3	0	0
Prior to 1921	5	21.7	0	0	18	64.3	26	55.3	3	15.8
Prior to 1941	6	26.0	1	20.0	24	85.7	35	74.5	11	57.9
Prior to 1961	12	52.2	3	60.0	27	96.4	37	78.7	13	68.4
Prior to 1981	22	95.7	5	100.0	28	100.0	47	100.0	19	100.0
Prior to 1987	23	100.0	5	100.0	28	100.0	47	100.0	19	100.0

Source: Environment Canada, Ottawa.

in assimilative capacities, it becomes abundantly clear that unless specific measures are adopted to avoid such disparities, the impact that pulp and paper manufacturing has on receiving environments will almost certainly be different in each region.

The regional differences that exist in relation to the impact that pulp and paper manufacturing can have on the receiving environment usually initiates some debate on the approach that should be used to protect the environment. At one extreme, there are those who argue that all mills should have to meet certain national standards of performance to ensure adequate protection for the nation's environment, regardless of location. At the other, there are those who argue that mills should only have to adopt those controls where expenditures can be justified on the basis of measurable impact on the local environment. The essential difference in these two extreme positions most often depends on the individual situation. Industry representatives can be expected to focus on issues that have the most impact on the competitive position of their company or mill operations; public administrators will focus on the administrative complexities and costs associated with ensuring an adequate level of protection for the total of the environment.

Even though both industry and government officials have a concern for equity and fairness, each has a perspective that relates to their respective position. Thus, those industry spokespersons who represent mills that are in environmentally sensitive locations can be expected to argue for national performance standards, and those mills in less sensitive locations will advocate control standards developed on the basis of measureable impact.[112] Those industry representatives with mills which already have the best in available pollution control technologies usually will argue for national controls, while mills with environmental control inadequacies will most often advocate the regional approach. The larger and more affluent companies will have a preference for national controls, while the smaller less affluent companies will prefer controls based on the needs of the local receiving environment. The essential difference in the positions being advocated by industry usually rests on the competitive position of the companies, and the economic costs of adopting the necessary controls at individual facilities.

While government administrators often understand the essential nature of the positions set forth by industry, they usually formulate their positions with respect to these two extremes on the basis of their mandated responsibilities. Those government officials with responsibilities that include a concern for all of the nation's environment, will have a preference for national standards. Those with their responsibilities confined to more limited geographic areas, usually will advocate a regional approach. Both sides of the argument recognise the difficulties associated with measuring and predicting the assimilative capacities of local receiving environments. However, each has a different perspective on the amount of detailed effort (administrative complexities and costs) necessary to provide an adequate level of protection for the environment. Thus, the essential nature of this debate among public administrators rests on the different perspectives which each side has on the best way to protect the interests of Canadians, without adding to the administrative complexities and costs of providing an acceptable level of environmental protection.

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[112] These views on industry perspectives are taken from the survey of industry and government officials, which was undertaken as part of this study. See: Appendix One.

Fortunately, the vast majority of industry and government officials are not advocates of either one of these two extreme positions, but such debate does help to illustrate the environmental and economic consequences of formulating an approach that does not take into account both sides of the argument. There is no doubt that the exclusive use of national performance standards would result in less administrative complexities and public costs for environmental protection. There is little doubt that regionally established standards would result in mills being treated differently in different parts of the country. However, much would depend on the criteria used to set the standards. Each of three different possibilities for establishing such standards are examined below. These are: (1) national standards based on the most environmentally sensitive locations, (2) national standards based on mills with the least impact, and (3) regional standards set on the basis of assimilative capacities at each individual mill's location.

National Standards Appropriate for Protecting the Most Sensitive Locations

If such standards were set on the basis of protecting the most sensitive environmental locations, it would provide Canadians with the maximum possible protection from the waste discharges of the industry.

However, it also would result in some mills having to make large and expensive investments on environmental controls, where such controls may not be justified on the basis of measureable impact. This necessarily would work to the advantage of mills in environmentally sensitive locations at the expense of those mills in less environmentally sensitive locations. There would be no incentive for new mills to locate in less environmentally sensitive locations. Therefore, even though such an approach could be perceived as fair and equitable, because all mills would be subject to the same requirements, it would not be administratively benign either regionally or in terms of affecting the competitive position of those in the industry. Those mills using environmentally disruptive processes and located in areas where environmental sensitivities are modest would share disproportionately in the costs necessary to maintain an acceptable level of environmental performance within the industry.

National Standards Designed to Minimise Mill Affects

National standards which are established solely on the basis of minimum safeguards without regard to environmental impact would have little or no effect on the competitive position of individual companies or mills within the industry. They would have little or no regional implications. All mills could operate with impunity regardless of the processes used or location. As such it could be expected that most industry representatives would consider them fair. However, such controls would have little or no affect in reducing the amount of pollution from the industry.

Neither would they be distributionally indifferent.[113] The use of national standards which are developed on the basis of mills that have the least impact on the environment, would amount to a public subsidy to the industry. Insofar as the administration of such a program could not be undertaken without adding to public expenditure, this in itself could be viewed as providing government financial support to industry.

Regional Standards based on Assimilative Capacities

Under circumstances where regional standards prevail, the environmental controls adopted by the industry would be appropriate to the environmental circumstances where mills are located. As a consequence, mills would not have to make expensive expenditures on environmental controls where measurable impact is undetected. Over time, it could be anticipated that such an approach would encourage new mills to locate in less environmentally sensitive locations. However, this approach would add substantially to the overall costs of administering a protection program, as a result of the need to conduct measurements on assimilative capacity at all mill locations. It also would result in placing a substantial burden on those mills that are using environmentally disruptive processes and are located in environmentally sensitive locations, to the advantage of mills in environmentally less sensitive locations. Regional standards would add to locational disparity, because of additional administrative complexities and the inevitable difficulties associated with measuring and predicting the assimilative capacities of contrasting receiving environments. As a result, this approach could lead to major distributional inequities both within the industry and regionally.

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[113] The term "distributional" is used to refer to shifts of income and benefits from one group within society to another. Sometimes distributional affects are considered good (shifts of income from the rich to the poor) and sometimes they are considered not good (shifts from the poor to the rich), depending on who is judging the merit of the change and whether they are affected. Some government actions are designed to have distributional affects and others are not. An environmental protection program is in effect a program which is meant to shift the disbenefits caused by pollution from the public to those causing the pollution. All other distributional affects that result from an environmental protection program are usually unintended, and therefore avoided where possible.

The foregoing comparisons provide a number of valuable insights about the environmental and economic consequences of any program designed to reduce pollution, which are not always envisioned by those who advocate the exclusive use of either a national or regional approach. First, any program designed to systematically reduce pollution necessarily causes a redistribution of benefits among members of society. Second, if an environmental program is not effective it imposes a cost on society, which benefits industry (society is allowing free use of publicly owned resources). Therefore, doing nothing to reduce pollution is not an economically realistic or socially desirable alternative. Third, if the environmental standards are set without regard to impact on industry, everyone loses. Industry will lose its competitive position in world markets, the larger society loses through the loss of jobs and income. Fourth, government environmental standards virtually always will result in altering the competitive positions of the various components within industry. The competitive disadvantages imposed on one group almost always are offset by advantages to another. Fifth, an effective environmental program can only be undertaken at some cost to both industry and the larger society (everyone is paying for the socially desirable right to live in a clean environment). Sixth, there are sufficient advantages in both national and regional approaches to suggest that the total of the nation's environmental concerns can be satisfactorily addressed at minimal cost to both industry and society, if used in combination.

There is little doubt that the interests of public administrators and industry coincide on a great many issues. Governments want to ensure that each citizen shares equally in the opportunity to live in an environment that is at least as good as those living in other regions. Industry shares in this concern on behalf of their employees, and in terms of creating and maintaining a work force with the skills appropriate to their requirements. Public administrators are concerned about providing each region with an equal opportunity to acquire new investment and employment opportunities without the burden of large investments on unnecessary environmental controls. Industry wants a good clean environment that is consistent with having continued access to a healthy forest base and a good supply of quality water. It wants the freedom to locate and invest in areas which offer the most in terms of competitive advantage. Both industry and governments want to foster an atmosphere consistent with the ideals of a free enterprise system, which allows industry to grow and create wealth over time with minimal government intervention. However, industry's views about what is mimimal intervention does not always coincide with government.

In the majority of cases, the industry's view of what is an acceptable level of government intervention rests on whether or not such interventions have any distributional effects on industry. The pulp and paper industry is a large and geographically dispersed collection of mills, which uses a wide range of processes that have different impacts on receiving environments with contrasting assimilative capacities. It is an industry that varies in importance between one area and another. It is not possible to establish an approach that does not have some distributional implications within the industry, and throughout society. The inevitable choices that have to be made in order to provide Canadians with environmental protection, necessarily requires the weighing of the interests of certain groups against the larger society. Such choices can not be made on the basis of concerns that relate to the relative competitive positions of individual components within industry. It cannot formulate environmental approaches solely on the basis of concerns of an individual region. Governments can establish arrangements that minimise the costs imposed on various segments of the industry, but it can not in all fairness to Canadians, formulate environmental approaches on the basis of these concerns.[114] The inevitable choice between protecting the environmental interests of the Canadian public and other interest groups in society is a matter that ultimately has to be made on the basis of public interest.

The arrangements that perhaps come closest to being justified in terms of these considerations is one that utilises some aspects of both national and regional approaches.[115] The use of an environmental approach that is based on national performance standards may not result in an ideal world, but neither does the use of an approach that deals solely in terms of local environmental impacts. National performance standards which are set as minimal acceptable public standards at least have the advantage of providing some level of protection for every Canadian from the environmental excesses that can occur. It is not in the national interest to adopt unrealistic standards which cannot be attained by industry.[116] The use of regional criteria to formulate the use of more stringent standards when appropriate not only protects the right of individuals, but ensures that individual components of industry will not suffer from excessive adherence to standards that are inappropriate to their individual circumstances. Government regional authorities will virtually always make some concessions to avoid the social disruptions which would result from imposing hardship on an individual mill, if such compromises are deemed to be in the public interest. Regardless of whether environmental standards are set nationally or regionally, there will inevitably be some distributional effects. Nonetheless, the use of national performance standards will minimise regional disparities over the long-term, providing that all new mills entering the industry are required to achieve a level of performance that is consistent with the best in available technology. This in itself does have distributional effects. It gives advantages to those already in the industry at the expense of those entering the industry. However, it also underlines governments'

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[114] James W. Parlour, "The Politics of Water Pollution Control: As Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970", Journal of Environmental Management, London, Vol. 13, 1981, p.147.

[115] The need for both environmental programs administered both nationally and regionally is not unique to Canada. Even much smaller nations such as Sweden find it necessary to undertake (Continued on next page)

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115 (Continued) environmental monitoring at both the national and local levels (regionally). See: Claes Bernes et al., "Design of an Integrated Monitoring Programme in Sweden", Environmental Monitoring and Assessment, Sweden, Vol. 6, 1986, pp.13-126.

[116] Neither is it in the public interest to have exceptionally low standards both for reasons previously stated on p.134, and because Canada could end up as a "pollution haven" for other countries unwilling to produce similar products because they want a clean environment (this will be discussed later in the report).

commitment to the socially desirable goal of having industry accept environmental costs as a necessary part of doing business in Canada.

Summary

In this Chapter, the historical use of the production methods used by Canadian pulp and paper manufacturers has been reviewed to assess the environmental performance of the industry over time. It has been revealed that one of the inevitable consequences of converting wood fiber into pulp and paper products is the generation of effluents and air emissions which are disruptive to the environment. Not all production methods generate the same volumes of wastes and not all waste materials have the same disruptive properties. Therefore, the environmental problems caused by the industry depends to a very large extent on the processes used and the environmental control measures that have been developed and implemented through the years.

Consistent with the attitudes of earlier times, the changes that took place during the early development of the industry were made without regard to environmental consequence. While the level of concern for environmental quality has changed considerably during the intervening years, not all changes that take place within the industry are necessarily to less environmentally disruptive techniques. The main motivation for the development and introduction of newer production methods is for reasons that mainly relate to the economic performance of individual companies or mills. This is not an indication that the industry, and the individual companies or mills which comprise the industry, are not concerned about the environment. It is an indication that the collective responsibility of industry is to produce products that are accepted by consumers in the marketplace. Industry's pursuit of market acceptance for the products it produces is the major reason for its long-term success. It also is a major cause for most of the environmental problems which have emanated from the industry through time.

The long-term trend within the pulp and paper industry has been to produce stronger, brighter, and more versatile pulps in response to public demand as registered in the marketplace. Because these are the pulps preferred by consumers, they command higher market prices, and generate greater economic returns. The better quality pulps require more handling, a greater amount of process modification and refinement. As a result, the manufacturing of these products is nearly always more environmentally disruptive than it is for lower grade pulps. The economic performance of the industry, as well as the individual components within the industry, depends on the monetary difference between what the consumer is willing to pay for final products and the cost incurred in producing, selling, and transporting these products to market. There exists, therefore, a natural incentive for industry to reduce materials input and waste output in an effort to maintain lower production costs. This ultimately leads to the development of technologies which result in cleaner, less environmentally disruptive, manufacturing techniques. Sometimes these new manufacturing techniques involve the development and manufacturing of by-products. More often they involve the recycling and reuse of materials which otherwise might be discharged as waste. In either case, the overall result of the industry's attempts to reduce production costs has been a decline in the amount of waste materials generated by the pulp and paper industry over time. This does not necessarily imply that the industry will always adopt less environmentally disruptive techniques. The pervasive long-term trend within the industry will continue in future, as it has been in the past, to produce the often more environmentally disruptive higner quality products demanded by consumers. However, it can be anticipated that there will continue to be improvements in environmental control technologies for those processes where the resulting products possess the characteristics demanded in the market.

The environmental controls adopted within the industry play a very important role in its environmental performance. On the basis of an examination of two major pulping processes (mechanical and chemical), five different manufacturing areas, and one production phase (bleaching), it has been determined that the most widely used processes are not necessarily the most environmentally disruptive. Those areas of production with the greatest pollution loadings potential are not necessarily those that cause the most environmental damage. As a corollary to this, it would appear that those mills which are responsible for the highest loadings, and are located in the most environmentally sensitive locations may not cause the greatest environmental harm. The most obvious reason for these discrepancies is the difference in quality of waste caused by each of the various processes and process phases used within the industry. Somewhat less apparent is the fact the incentives for developing and implementing technologies to reduce discharges also differ with each of the different processes and processing phases. As a consequence, the ability to control waste also differs with each production method. The pollution loadings caused by industry are a function of both the pollution properties which are an implicit part of each of the processes used, and the ability and willingness of industry to adopt the necessary control technologies.

The pollution control technologies which are available cover every phase of production used in the industry. The wastes reduction efficiencies which can be achieved with each of the various methods of internal and external controls and treatments indicate that technologies exist to provide an acceptable level of protection for both air and water from most known pollutants. However, it is seldom economically possible to control waste discharges to the limit of the technologies that are available. It is not always possible to control particular pollutants (i.e. toxicity, colour, and odor) to acceptable levels using what might be perceived as readily available prescriptions as automatic remedies to the pollution problems that exist at a particular mill. As a result, environmental safeguards usually have to be employed on the basis of the environmental and economic circumstances at the individual facility, rather than on the basis of the best known technical solutions available.

The use and application of environmental control and treatment measures on the basis of the circumstances at each individual mill has considerable intuitive appeal. It is the approach most often advocated by industry representatives, and usually is supported by those who study and document pollution problems within the industry. However, the successful development of an environmental control strategy for an individual facility almost always requires the combined application of internal and external controls. The willingness of companies and mills to apply the available environmental controls technologies in a balance appropriate to the environmental requirements of a facility can be expected to vary quite substantially. For example, external treatments are capital intensive developments that always add to the production costs without yielding any cost reductions. The high cost of the additional expenditures associated with these types of controls are normally resisted by industry. In contrast, internal controls modifications practically always yield some production costs savings, but the economic feasibility of adopting internal controls differ. At one extreme, it is simply not economically feasible to implement certain types of internal controls. At the other, it is not only economically feasible, but in fact an attractive investment.

In most situations, internal controls modifications provide some production costs savings, but they are not usually an attractive investment when compared with other investment alternatives available to a company or mill. The overall consequences of this is that there is an optimal combination of internal controls and external treatments which can be provided at minimal cost to the individual mill. However, in most cases the technically feasible balance of controls appropriate to an individual situation will not be concomitant to what is the least cost balance of controls. Moreover, only very seldom will the perceived obligation of mill operators coincide with either one or both of what might be considered the most technically or economically desirable combination of controls.

To a very large degree, the receptiveness of a company or mill to the adoption of a combination of internal controls and external treatments will rest on the perceived obligation of the company or mill to install the necessary environmental safeguards. If the company or mill is given a choice on how best to achieve certain standards at some indefinate time in future, then the company or mill will practically always opt for internal controls. The reasons for this choice are obvious given the difference in the economic implications of internal controls and external treatments, and the often perverse incentives for a company or mill to delay the installation of environmental measures. When a company or mill is required to meet certain standards within a firmly established time-frame, then except in those instances where space is unavailable for external treatments, the company or mill officials practically always will choose some combination of internal and external controls. A combination of internal controls and external treatments offers greater flexibility for future expansion. It allows the mill to meet preset standards with minimal interference with internal production capabilities. It reduces the economic risks associated with having to adopt additional environmental controls at some later date, because of unanticipated future environmental emergencies. Finally, it facilitates a greater reduction in overall environmental impact at lower total direct cost to the mill, providing that the environmental obligation to the mill is clearly understood by those operating the facility.

There exists a substantial amount of empirical evidence to indicate that only infrequently will a mill close down because of the need to implement environmental safeguards, if the operation is otherwise economically sound. Even an economically marginal operation will usually have a number of choices available to avoid closure. However, this does not mean that large investments in environmental controls will always be economically feasible, or that the cost of controls will not detract from the economic performance of a company or mill at a particular point in time. In some cases, the installation of environmental safeguards will have to be phased in over a period of time, as part of an ongoing capital expenditure program. Under such circumstances, environmental controls should be set on the basis of priorities established within a framework of agreed upon criteria. When biological impact assessments are used in conjunction with the blended use of internal and external controls, it becomes possible to establish priorities on the basis of environmental necessity. The use of a biological assessment eliminates the possibility of a mill adopting environmental control safeguards to reduce wastes, which do not have a measurable environmental impact. It reduces the risks of implementing measures which do not resolve environmental problems as anticipated. There is little question that individual companies or mills are more likely to make a commitment to adopting the necessary environmental safeguards, when scientifically valid evidence on the biological impact of a mill operation is available.

Within any system designed to address the environmental problems of an industry as technically, economically, and locationally diverse as the pulp and paper industry in Canada, there exists tremendous scope for disparity. Environmental controls are meant to shift the disbenefits associated with pollution from the public to those causing the pollution. The tolerance of water and air to absorb wastes varies substantially according to location. The effect that implementing environmental controls differs according to the production methodologies employed, and the economic circumstances of the individual company. The socio-economic importance of the industry varies according to region. Thus, there is a need to make choices which requires the weighing of the interests of one group off against another. Such choices cannot be made on the basis of concerns that relate to the relative competitive advantage of individual components of the industry. They cannot be made solely on the basis of concerns of individual regions. They must be made on the basis of what is in the best overall public interest.

The regulative regime that comes closest to best serving the public interest is one that includes the use of both national and regional approaches to environmental protection. Standards which are set nationally and administered regionally can be used to ensure that a minimal standard of environmental protection for all Canadians, so that each individual has an opportunity to enjoy a quality of life at least as good as those living in other parts of the nation. Standards which are set and administered on the basis of regional priorities, protect the rights of individuals and industry from the excesses which can occur from the strict adherence to requirements that are inappropriate to individual circumstances.

The analysis and discussion undertaken in this Chapter clearly shows the need for government intervention on behalf of the public to protect society from the environmental excesses that can occur as a result of pulp and paper manufacturing. Left to its own devices the industry will not necessarily provide a level of environmental protection appropriate to the needs of Canadians. This is not to suggest that industry always resists implementing environmental controls. There are many circumstances where the environmental and economic concerns of the public are shared by industry. In fact, on the basis of the analysis undertaken in this Chapter it is safe to conclude that the industry has made a very large contribution to reducing the amount of effluent and wastes it discharges into water and air. However, the motivation for these reductions has been mainly for reasons that relate to reducing production costs, in order to provide a reasonable return on investment for owners. The industry's obligation to its shareholders benefits all Canadians through the creation of wealth, income, and employment. The existence of this obligation, nonetheless, does draw attention to the important distinction of having to provide society with products demanded in the marketplace in order to survive as an industry, and the responsibility that industry shares with all elements and individuals in society for protecting the environment. It is a distinction that brings into focus the difficulties associated with exacting trade-offs among industry components and the larger society, when there is a shared major, but not necessarily equal, concern for sustained industrial growth and maintaining a clean and healthy living environment. It is a distinction that clearly suggests that if there is fault to be found for the environmental disruptions caused by the pulp and paper industry, it is a communal one in which all society shares.

CHAPTER THREE

FEDERAL ENVIRONMENTAL REGULATIONS AS APPLIED TO THE PULP AND PAPER INDUSTRY IN CANADA

In the previous Chapters, the number and types of mill processes were discussed. The changes in the structure of the industry and its growth over time have been described. In this Chapter, the intention is to: (1) provide a brief overview of the federal and provincial governments' historical involvement in waste management and water pollution control, (2) describe the mandate and the perceived responsibilities of the Federal Government, and more specifically, the Department of the Environment as it relates to controlling industrial waste discharges, (3) outline the federal legislation and regulations as they apply to the pulp and paper industry, (4) describe the administrative dilemma associated with establishing and enforcing the pulp and paper effluent regulations, (5) examine the performance of federal Environmental Protection in administering the pulp and paper effluent regulations, and (6) review the appropriateness of the regulations in terms of the current administration framework.

Background

Traditionally, there has been a substantial overlap between the different levels of government and among agencies in air, water and pollution control as a result of the powers set out in the Constitution Act, 1867 (formerly The British North America Act, 1867). According to the Constitution Act, the provincial governments are dominant in those areas which are likely to affect air quality. The Federal Government using both its commerce and international responsibilities is able to exercise control over air emissions. The provinces have legislative jurisdiction over water by virtue of their proprietary interest in natural resources. Water is a concern of the Federal Government through its jurisdictional responsibilities in relation to navigation, northern development, fisheries, and its residual legislative authority for peace, order, and good government. The overlapping authorities that result from shared jurisdiction over air and water has meant that, historically, both levels of government have been involved in activities associated with pollution control.[1]

Generally, the respective responsibilities of the federal and provincial governments on pollution has been vague. While most legal authorities are willing to concede provincial authority over pollution with respect to municipal water supplies and tort liability in general, they also have been willing to give recognition to federal authority in matters of pollution. As previously mentioned, this recognition of federal authority was based mainly on its responsibilities in northern development, navigation, and fisheries. Once again, however, it also pertained to the Dominion public health legislation and the "peace, order and good government" clause of the Constitution Act, 1867. The argument was then, as it remains today in the Canada Act and Constitution Act of

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[1] Bora Laskin, "Jurisdictional Framework for Water Management", Proceedings of Resources for Tomorrow, Conference held in Montreal, Oct. 23 to 28, 1961, p.218. Leslie Shaw, Constitutional-Legal Underpinnings of DOE's Role in Resource and Environmental Management in Canada, Ottawa, (no date) p.3.

1982, that Parliament could and - as a large segment of the population believe - should assert authority over pollution in the interests of general health.[2]

As a result of the recognised concurrent authority of the federal and provincial governments, both levels of government have long been involved in activities aimed at waste management control. Federal involvement in industrial pollution abatement goes back to the turn of the century when the then Department of Marine and Fisheries regularly conducted experiments on the impact of the industrial waste discharges, including the impact that effluent discharge from pulp and paper mills would have on fish and fish habitat.[3] On the East Coast, the testing of the effluent discharges from pulp and paper operations ultimately resulted in the systematic monitoring of the effluent discharge from individual mills, and the negotiation on a mill by mill basis of the installation of waste treatment facilities. By the 1960's, the monitoring and negotiation of waste treatment facilities had become an ongoing activity of the Department of Fisheries and Forestry and some form of pollution abatement treatment had been negotiated with every East Coast pulp and paper mill considered a serious threat to fish and fish habitat (Fraser Companies, Edmunston, N.B., Scott Paper, Abercrombie, N.S.).[4] Similarly, on the West Coast, the first pulp and paper mill in British Columbia commenced operation at Port Alberni in 1894.[5] Investigations by the Fisheries Research Board of Canada in cooperation with the Water Resources Branch of British Columbia during the period 1939-1946, eventually resulted in the stipulation of allowable effluent discharge limits for the Port Alberni mill operation in 1949. The negotiations for biological treatment at the same mill commenced in 1965. When it is recognised that Canada had only 53 pulp and paper mills in 1901, it can be seen that the Federal Government has been active in controlling the waste discharge from pulp and paper mills from an early stage in the development of the industry in Canada.[6]

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[2] Ibid., p.218.

[3] Annual Report of the Department of Marine and Fisheries, Fisheries Branch, 32nd Annual Report, supplement to sessional paper no. 22a, 1901, pp.12-13.

[4] Annual Reports of the Department of Fisheries, and the Department of Fisheries and Forestry, Ottawa, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971.

[5] Summaries of Fisheries Research on Pollution Problem, Department of Fisheries, Vancouver, August 1965, p.c1.

Efforts at pollution abatement were not limited to a readily recognisable group of agencies in the Federal Government, or just to federal and provincial ministries. There were a whole host of federal and provincial agencies, crown corporations, and the like (i.e., the International Pacific Salmon Commission) working under the authority of more than 80 different pieces of legislation involved in data collecting, monitoring, researching, and in regulating the control of effluents. With rising concern about environmental matters that first became apparent in the late 1950's, and which grew steadily throughout the 1960's, the public and industry became increasingly adamant that greater coordination was necessary to bring about order and reduce the uncertainty within the regulatory process. Public interest in greater coordination was directed mainly at facilitating more effective control over waste discharges. Industry was concerned about the number of different regulatory agencies to which they had to respond. This myraid of government process, often resulted in industry receiving inconsistent, or even contradictory advice on the measures that were to be taken in the interests of environmental protection. Therefore, despite some early successes in reducing the amount of waste discharged into the environment by industry, overlapping jurisdiction, inconsistency of application, and lack of coordination led to the need for a more structured framework for regulating waste discharges.[7]

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[6] Canadian Pulp and Paper Association, Reference Tables, Annual Reports.

Emergence of the Department of the Environment and Its Waste Control Responsibilities

In 1970, the Parliament of Canada passed the Government Organizations Act, which created the Department of the Environment (DOE). The specific responsibilities of the new department as outlined in the Act were the "protection and enhancement of the quality of the natural environment, including water, air, and soil quality".[8] The principle legal mechanisms initially were the Fisheries Act and the Canada Water Act, of 1970. Subsequent legislation to augment these responsibilities and the Federal Government's delivery capability includes the Clean Air Act of 1971, the Ocean Dumping Control Act of 1975, the Environmental Contaminants Act of 1975. This legislation together with the 1973 Cabinet directive on solid waste management places the major authority for waste management control within the Federal Government in the DOE. The Canadian Environmental Protection Act of 1988 appears to demonstrate the government's intention to have the DOE remain the main focus for such authority within the Federal Government. Although the DOE is now, and will likely remain, the main waste control authority within the Federal Government, it is not the sole federal authority for waste control. Others who share such authority include, but are not limited to Indian and Northern Affairs, Transport Canada, and Agriculture Canada. However, the main responsibility for industry waste control is vested in the DOE under the authority of Section 33 of the Fisheries Act and some mutually agreed upon administrative arrangements between the Department of Fisheries and Oceans (DFO) and DOE.

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[7] T.M. Pattison, "Administrative Framework for Water Management: Proceedings of Resources for Tomorrow Conference held in Montreal, Oct. 23 to 28, 1961, p.245.

[8] Government Organizations Act, 1970.

The amendments to the Fisheries Act that enabled the adoption of the industry waste control regulations were brought to the Standing Committee on Fisheries and Forestry in May of 1970. The purpose of the amendments as outlined by the then Minister of Fisheries and Forestry, the Honourable Jack Davis, was to protect the aquatic environment from pollution.[9] The proposal put forth by the Minister was that the Fisheries Act should be strengthened to allow the Federal Government to cope more effectively with the mounting pollution problems resulting from modern industry.[10] The aim of the water pollution regulations, very similar to the guidelines subsequently established under the Clean Air Act, was to provide a uniform nation-wide pollution control standard that would delineate a leadership role for the Federal Government,[11] which was appropriate to its constitutional responsibilities.[12] An important element in the approach to be adopted was the provision of mechanisms which would facilitate coordination among Federal Government departments and between different levels of government by identifying a focal point within the new department to establish direct contact with provincial agencies.[13] Thus an important feature was to influence the activities of non-resource federal agencies in such a way so as to upgrade and safeguard the state of the environment. As was cautioned at the time that the amendments were outlined to the Standing Committee, the intention was not to provide a "cure-all" that would solve all of Canada's pollution problems.[14] The regulations and guidelines were not to be used as a means for the Federal Government to assert control over pollution in Canada. The legislation as referred to at the time was "enabling legislation",[15] that would allow the Minister of Fisheries and Forestry (later the Minister of Fisheries and the Environment) to establish a framework for reducing industrial pollution over time in cooperation with the provinces and industry.

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[9] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, April 30 1970, p.19:7.

[10] Ibid., p.19:8.

[11] The Honourable Jack Davis statement recorded in Hansard for the House of Commons, January 27 1971, p.2827.

[12] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, April 30 1970, p.19:7 and March 10 1971, p.1:7.

With the establishment of the Department of the Environment, the Environmental Protection Service (EPS) was assigned the lead role on matters relating to environmental quality. With this, the Environmental Protection Service became the major, but not necessarily the sole force for industrial waste control within the DOE.[16] However, its most significant responsibilities in terms of controlling industrial waste, and the ones that relate most directly to the administration and enforcement of environmental standards for the pulp and paper industry, are encompassed within some mutually agreed upon administrative arrangements with DFO.[17] Among the most important of these arrangements is the "Lucas-Weir Memorandum of Understanding". This arrangement which survived the removal of the fisheries mandate from the DOE in 1978, allowed the then EPS to adopt national base line effluent regulations for industry, negotiate solutions to pollution problems, enforce federal legislation, and to act as the single point of contact for problems relating to the enhancement and protection of the natural environment.[18] As a result of this agreement, and the enactment of clean air legislation, the EPS acquired the necessary authority to provide the consistency and coordination to industry pollution control that was one of the Federal Government's stated reasons for the establishment of the Department of the Environment.[19]

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[13] Ibid., April 27 1971, p.7:15.

[14] Ibid., April 30 1970, p.19:13, May 4 1970, p.20:33 and May 12 1970, p.22:51.

[15] Ibid., April 27 1971, p.7:28.

[16] The Environmental Protection Service (EPS) became Environmental Protection (EP) within the newly formed Conservation and Protection (DOE) in 1987.

On May 6, 1985, another Memorandum of Understanding between the Deputy Ministers of DOE and DFO was signed, which once again reaffirmed the previous 1971 agreement.[20] However, this agreement also specified the need for better cooperation and allowed for a series of sub-agreements that has, and undoubtedly will in future, result in changes to some aspects of the original Lucas-Weir agreement.[21] Nonetheless, it is the existence of this agreement between the two departments, in consort with the wishes of government, which provides the EP with the necessary authority to administer the pulp and paper regulations in a manner consistent with the intentions of Parliament.

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[17] Lynne Huestis, Pilot Study Report S.33 Fisheries Act, Department of Justice, December 1985, p.11.

[18] Lucas-Weir Memorandum of Understanding, October 28 1971.

[19] Lynne Huestis, op. cit., p.10.

[20] May-Gerin, Memorandum of Understanding, May 6 1985.

[21] Regional Working Agreement, between DOE and DFO for the administration of Section 33 of the Fisheries Act in B.C. and the Yukon, DOE, May 1987. This agreement, in contrast to the previous Lucas-Weir agreement, also maintains the right of DFO to take direct unilateral action in those circumstances where fisheries resources are threatened.

The Conditions Laid Out by Parliament

Even though the amendments to the Fisheries Act were made for the purpose of reducing all industrial waste, the intention appears to have been to start with the pulp and paper industry.[22] The Minister of Fisheries and Forestry as well as his parliamentary colleagues were well aware of the threat to the environment posed by unrestrained waste discharges by industry, but they also were aware of the importance of industry to Canadians. It was generally conceded that there was a potential threat to the public if industry regulations were applied in an indiscriminate manner. Thus consistent with virtually all government intervention which is designed to eliminate some perceived inequity or distortion that might impose hardship, elected officials had to decide whether society as a whole would benefit as a result of what is being asked, and on the best way to intervene so as to ensure the greatest good.

When the amendments to the Fisheries Act and the environmental regulations were debated in the Standing Committee and in the House of Commons, questions were asked about the impact that the changes would have on industry and the communities most affected by the new legislation. In other words, the economic and social consequences of the legislation was a major concern to political leaders, when they were assessing changes in the legal authority of the government to impose pollution control regulations on industry. Those sponsoring the new legislation and their supporters responded by making commitments to take into account the concerns of industry, as well as those who depend on the industry for a living. Mr. Davis when describing his intentions with respect to the pending pulp and paper regulations assured both the Standing Committee and members of the House of Commons that these regulations would be enforced using a timetable set through negotiation on a mill by mill basis which would take into account the economic circumstances of the firm and the social economic welfare of the communities involved.[23]

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[22] It was at the time Mr. Davis introduced the Bill establishing DOE, that he indicated that in bulk tonnage terms the pulp and paper industry contributed close to 50 percent of industrial waste dumped into Canadian waters. See: Jack Davis statement recorded in Hansard for the House of Commons January 27 1971, p.2827.

The determination of the Federal Government to avoid imposing unnecessary economic and social hardship on the pulp and paper industry, and those who depend on the industry for a living, was subsequently reconfirmed in 1976, when the Fisheries Act was once again amended. One of the Standing Committee members, indicated that it was his feeling that the costs associated with adopting environmental control measures would restrict the expansion of the pulp and paper industry and prevent them from creating new jobs and trying to build-up the industry over time. Those who were supporting amendments to the Fisheries Act were asked about older mills and how new standards would be applied.[24] Mr. L. Edgeworth (former Assistant Deputy Minister of EPS) in supporting the need for the proposed amendments stated:

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[23] Recorded in Hansard of the House of Commons, November 9 1971, p.9473, January 27 1971, p.2828.

[24] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, Bill C38 - An Act to amend the Fisheries Act and to amend the Criminal Code in consequence thereof, Second Session, Thirteenth Parliament, 1976-7, p.34:59.

> ...there are cases in between where we feel we can negotiate a compliance schedule over a reasonable period of time. In other words, we do not feel that it should be done this year or maybe next year, or maybe not in 1980, but certainly we should be making some progress towards a reasonable compliance schedule.[25]

Therefore it was then, as it continues today, to be the intention of the government that the pulp and paper regulations should be administered in a manner, which takes into account the socio-economic consequences of those directly affected by the regulations. It is the need to take into account these concerns, which are expressed by elected officials on behalf of all Canadian citizens, that result in legislation that is usually broad enough in scope so as to allow for economic adjustments to avoid social hardship. Without such assurances by those supporting environmental control legislation it is doubtful that such legislation would have been successfully adopted and implemented.[26]

The Formulation of the Pulp and Paper Effluent Regulations

The basic principles outlined by Mr. Davis in his various speeches leading up to the establishment of the pulp and paper effluent regulations were developed in accordance with the socio-economic concerns expressed by Parliament. According to Mr. Davis, the new regulations were to be adopted with adherence to the following:

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[25] Loc. cit.

[26] The Federal Treasury Board in December 1970 established a process requiring that all new regulations or amendments to existing regulations relating to health, safety, and fairness be subjected to Socio-economic Impact Analysis (SEIA). These Treasury Board requirements were amended in September 1986 to what is referred to as a Regulatory Impact Analysis Statement (RIAS), which like the SEIA requires an examination of the impact of both new legislation and amendments to existing legislation. RIAS have the same basic intention of the SEIA, but with somewhat less emphasis on measuring the precise socio-economic cost-benefit calculations.

1. They were to be minimum standards that would be applied on a nation-wide basis, and thereby, eliminate the possibility of "pollution havens".[27]
2. Industry was to be put on notice that they were expected to meet these new standards, but they were to be given time to adjust. New plants were to conform immediately, but old plants were to have time to adopt cleaner processes.[28]
3. In an effort to take account of the different processes used in manufacturing pulp and paper and to ensure fairness in application, the new regulations were to be technology based rather than depend on the largely unknown assimilative capacity of certain surroundings.[29]
4. Industry was to control its waste by recirculating it within the confines of its own "factory fence", so that waste could be treated before discharge.[30]
5. The new regulations were to be prepared in consultation with the provinces and industry, so that they would be supportive rather than disruptive to the efforts already in place. The regulations were to compliment provincial regulations, and at the same time, required industry to assume a greater share of the costs imposed on the public as a result of pollution abatement.[31]

With these basic principles, Mr. Davis clarified what was perceived by the Federal Government as its role in helping to reduce industrial waste.

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[27] Jack Davis, Minister of Fisheries and Forestry, in an address to the Regional Liberal Conference in Courtenay on Vancouver Island, September 26 1970.

[28] Jack Davis, Minister of Fisheries and Forestry, in a speech to delegates attending the Fraser Valley Regional Liberal Conference, Langley, B.C., October 3 1970.

[29] Parliamentary Hansard, House of Commons Debates, Government Organizations Act, Honourable Jack Davis, January 27 1971, p.2830.

[30] Jack Davis, Regional Liberal Conference, September 26 1970.

[31] Parliamentary Hansard, House of Commons Debates, Government Organizations Act, Honourable Jack Davis, January 27 1971, p.2827.

Pulp and paper effluent regulations were passed into law during November 1971. In keeping with Mr. Davis's stated intention of having national regulations applied uniformly nation-wide, a task force was established to develop standard discharge levels for the industry. While industry did not have any direct say in the philosophy used to develop these standards, or to the timing for compliance, the regulations as ultimately adopted reflect a compromise between the representatives of the pulp and paper industry and the views of government. The permitted deposits of allowable discharges, represented as numerical values in the regulations, were established by a reconstituted task force comprised of federal, provincial, and industry representatives.[32] This task force recommended that the pulp and paper industry use internal process controls rather than depending on external treatments to reduce effluent discharge. The ultimate result was a set of effluent regulations for the pulp and paper industry that have two requirement standards, and three levels of compliance. The requirement standards are based on a distinction between "old mills", built prior to November 24, 1971, and "new mills" built subsequently. The three levels of compliance include a more stringent standard for new mills, a somewhat less restrictive target for old mills, (referred to as existing mills in the regulations) and a standard somewhere in between the new and old for existing mills that undergo modification. The standards are to be enforced on the basis of monitoring information gathered at individual mills. The requirements as adopted by government and enforced by EP are based on what is referred to as "best practicable technology".[33]

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[32] The original task force was made up of Federal Government employees without provincial or industry representation. As a result, the draft regulations proposed by the original task force were resisted by industry. See: J.L. Keays, K. Jackson, Effluent Standards for the Canadian Pulp and Paper Industry - Report on Recommendations of Regulations Development Team, Ottawa, January 1972, p.14.

The effluent regulations were augmented by air emission guidelines for the pulp and paper industry in 1979. Under the authority of the Clean Air Act the EPS established air emission guidelines which were developed in conjunction with the provinces and industry. Like the effluent regulations, the air emission guidelines are national in scope and based on best practicable technology.

Federal Program Objectives and Delivery Mechanisms

The principle objective of Environmental Protection is to ensure that human activities are conducted in a way that will achieve or maintain a state of environment necessary for the health and well-being of man, the health and diversity of species and of ecosystems, and the sustained use of natural resources for social and economic benefit.[34] Within this overall objective, the Industrial Programs Branch in cooperation with regional offices is responsible for reducing industrial effluent discharges. The Industrial Programs Branch compiles information provided by environmental agencies in the regions to measure the overall nation-wide level of waste discharges into the environment. This Branch also is responsible for acquiring the knowledge necessary to maintain a center of expertise on industrial processes. It interprets waste discharge information so that the most up-to-date information on the latest technology is available. This Branch in conjunction with regional offices, also maintain liaison with industry and with other government agencies for the purpose of advising on the production processes that are least damaging to the ecosystem. Thus the responsibility for program delivery as it relates to the pulp and paper industry is the responsibility of both Industrial Programs Branch and the five regional offices of EP (See Appendix V).

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[33] Best practicable technology is defined as technology that has been proven commercially as economically feasible, and which is consistent with the protection of the environment.

[34] Environmental Protection Service Strategic Plan, June 1982, p.4.

In accordance with the EP principle objective, the five regional offices in conjunction with the Industrial Programs Branch use both the more general provisions under Section 33 of the Fisheries Act, and the effluent regulations to control and reduce the impact of waste discharges. The air emission guidelines are administered in cooperation with provincial governments. The mechanisms used include: (1) the ongoing monitoring of effluent discharges to measure the level of compliance with national regulations and regular reviews of air emissions, (2) the maintenance of a regional referral system among federal agencies and between different levels of government, (3) the use of formal federal-provincial agreements, (4) maintaining an immediate response capability for the containment and clean-up of unexpected spills, and (5) encouraging the use of cleaner processes through industry assistance programs.

The Monitoring of Effluent Discharges and Air Emission Reviews

Federal air emission guidelines, although similar to the effluent regulations in many important respects, are not regulations that can be enforced under weight of law. They are national guidelines which were designed to help the individual provinces establish standards which would be comparable nation-wide.[35] As a consequence, unlike the effluent regulations, there is no monitoring program for pulp and paper air emissions which is applied consistently in each region across the country.[36] There are a number reasons for this. First, the Federal Government's involvement in air quality is based on protecting health and international obligations. Second, the provinces are responsible for air emissions from industrial plants located within their boundaries. Third, under extraordinary conditions air emissions from pulp and paper mills can create environmental problems in a limited local area, but as noted earlier in Chapter Two such emissions are usually more of a nuisance in terms of generating unpleasant odors rather than posing any danger to human health. Fourth, in the unlikely event that emissions from a pulp and paper mill were to pose a threat to human health, it would be handled by the regional emergency program group which would take appropriate action.[37] Finally, the air quality monitoring stations operated by EP, together with the provincial monitoring programs, provide protection for the public from severe or life-threatening discharges emanating from a particular geographical site.

While the pulp and paper emission guidelines do not specify the need for the ongoing monitoring of discharges into the atmosphere, the existing effluent regulations do require a monitoring program to determine the degree to which each mill is either in or out of compliance with national effluent standards. The effluent monitoring program is carried out using two mutually supportive techniques. The first is an industry self-monitoring program that requires each mill to measure and keep record of its discharge flows, and to sample for BOD, TSS, and toxicity to fish. The second is a program whereby employees of government randomly take samples of all mill discharges and conduct laboratory analysis of the samples. The vigor with which the monitoring activities are conducted varies across the country, because such monitoring is undertaken either through or in cooperation, with provincial or local authorities. The degree of cooperation between federal and provincial authorities differs according to the relationships established at the regional level. Nonetheless, the monitoring program is perceived as effective in terms of determining the degree of compliance, encouraging cooperation between levels of government, and having industry take an active role in reducing discharges into the environment.

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[35] Some provinces have adopted the standards contained in the federal air emission guidelines as a requirement for mills located within their jurisdictions.

[36] The reader should note that EP operates a number of sampling stations across Canada to measure air quality. These sampling stations are designed to determine ambient air quality conditions in general rather than to monitor point source industrial emissions.

[37] See subsequent discussion on immediate response capacity of EP.

The Regional Referral System

An important part of the overall strategy used to control the discharge of waste material is the referral system used between different levels of government and among agencies at the regional level. In most regions, the referral system is based on informal arrangements, whereby one agency keeps other agencies informed about pending or planned developments that have environmental significance. In other regions, such as in British Columbia for example, the referral system has been set-up on a semiformal basis, whereby provincial applications for approval to discharge waste material are sent to EP officials by the provincial Waste Management Branch for comment. The B.C. regional office of EP circulates these applications among federal agencies, who may contact the developer directly for details on their plans. In the vast majority of cases, the various agencies will agree on the steps necessary to protect public interests. In a few instances, when an agreement is not readily forthcoming, negotiations take place. On rare occasions, when negotiations do not resolve the total of the concerns, individual agencies may choose to exercise their legislative authority and unilaterally intervene in the development. In other provinces, the combined working efforts of the two levels of government are such that it would prevent the casual observer from distinguishing between federal and provincial personnel. In other regional settings, the interchange between federal and provincial personnel is minimal. Although the referral system differs in each region across the country, it is generally applied in a manner consistent with the circumstances that prevail in each provincial jurisdiction.

The Use of Formal Federal-Provincial Agreements

In some provinces, the referral system extends to more comprehensive agreements that are designed to ensure that environmental concerns are addressed comprehensively, and in such manner so as to avoid duplication of effort. These arrangements take the form of federal-provincial agreements called Accords, in which federal and provincial environmental authorities agree to integrate control requirements, exchange monitoring and technical information, and consult as necessary. Under the provisions outlined in these agreements, the provinces assume the lead role on enforcement matters, but they also agree to enforce requirements at least as stringent as those required under federal regulations.

Even though Accords have been established in only seven of ten provinces (British Columbia, Quebec, and Newfoundland have not entered such agreements), these agreements together with the referral system ensures that each region has an administrative framework in place which encourages cooperation between governments and among agencies on environmental matters.[38] Together they help to facilitate a coordinated, comprehensive, and orderly approach by government in reducing the discharged wastes into the environment. These mechanisms allow for the provision of consistent advice to the pulp and paper industry in each region. They also serve to reduce the number of environmental agencies with which the industry must interact for establishing safeguards for reducing waste discharges.[39]

Immediate Response Capacity of EP

The mechanisms described in the foregoing outline the procedures that are being used to reduce industrial waste discharges into the environment over the long-term. They are mechanisms that: (1) ensure that environmental safeguards are built into new developments, (2) maintain a vigilance on the waste being discharged into air and water, and (3) provide for the enforcement of standards set out under the federal regulations. These mechanisms, when applied together in a prudent manner, may result in the natural rejuvenation of ecosystems damaged due to past excesses. Unfortunately, the majority of the most critically and environmentally damaging events are not the result of calculated or deliberate acts by industry or individuals acting in their own best interest without regard to the public. In the overwhelming majority of instances, when severe or even life-threatening pollution contamination takes place, it results from unexpected disruptions to production processes, unforeseen breakdown in safeguard systems, or even unanticipated natural phenomenon. As noted in Chapter Two, the pulp and paper industry does not appear to be any less prone to unanticipated spills than many other industries.[40] It follows, therefore, that to a significant degree the protection of the public's right to a clean and healthy environment depends on the ability of environmental agencies to respond to unforeseen events. In this regard, EP has what is known as the Environmental Emergencies Group in each region. The Environmental Emergencies Group is responsible for responding to unforeseen disruptions that require immediate attention. They provide a direct communications link with individual citizens. As required, they provide the federal Minister of the Environment, and through the media the general public, with information on the nature and severity of unexpected spills. They work with other federal, provincial, and local authorities to initiate and coordinate corrective action to safeguard the public. In addition, they work with these same agencies, and with industry, to limit the severity of the damage and to initiate clean-up. Although the number of severe emergencies caused by the pulp and paper industry are comparatively few, the Environmental Emergencies Group is a most important element in ensuring a total federal network of mechanisms necessary to protect the environment in a manner that is in the best overall public interest.

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[38] The Accords with some of the provinces have expired, but new initiatives are underway to conclude the new agreements. See: Dr. Robert W. Slater, "The Federal Perspective", Environmental Protection and the Canadian Constitution, Proceedings of the Canada Symposium on Jurisdictional Responsibility for the Environment, ed. Donna Tingley, Environmental Law Centre, Alberta, 1987, p.10.

[39] This does not necessarily mean that industry will not have to deal with both federal and provincial personnel in each province. Generally it can be said that the mills do not have to deal with more than one agency from each of the two levels of government.

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[40] See: Chapter Two, p.105.

The Encouragement of Industry to Use Cleaner Processes

The EP has been directly involved in programs to help industry develop and use less environmentally disruptive production processes over many years. These programs are designed to supplement the efforts of industry and the provinces in helping individual mills to reduce pollution loadings. Those programs that relate directly to the pulp and paper industry include: a) Accelerated Capital Cost Allowance (ACCA), b) Co-operative Pollution Abatement Research (CPAR), c) Development and Demonstration of Pollution Abatement Technology (DPAT), d) Demonstration of Resource and Energy Conservation Technology (DRECT), and e) Pulp and Paper Modernisation (PPMP).

a) Accelerated Capital Cost Allowance

The ACCA was the first financial incentive program used in Canada for purpose of encouraging business to control pollution. The ACCA program allows business to depreciate the cost of installing pollution abatement equipment or processes over a two year period, and grants rebates of the federal sales tax on the purchase of discharge or emission control equipment. This program was first applied to water pollution control equipment in 1965. It later was extended to include air pollution control capital expenditures in 1970. In 1972, the ACCA was extended even further to include all primary manufacturing or processing capital equipment. The overall result of the 1972 changes is that pollution control capital investment is treated like all other production process equipment expenditures. In fact, most pulp and paper manufacturers often find it less difficult to apply for such allowances under the more general provisions of the program than as part of the somewhat more restrictive provisions, which apply to capital investments on environmental pollution controls. Nonetheless, information gathered by Ottawa EP personnel indicates that industry (not just the pulp and paper industry) approved claims of $118 million and $39 million respectively for water and air pollution control equipment during the two year period 1984 to 1985.[41] The general provisions provided for under the ACCA result in understating the total expenditures made on pollution control equipment by industry.

b) Co-operative Pollution Abatement Research

The CPAR program was initiated in 1971 to provide incentive for the pulp and paper industry to undertake research in pollution abatement technology for application within the industry. Although not all the proposals submitted for funding under CPAR received financial support, the more than 900 applications received under the program demonstrate the popularity of CPAR within the industry. Between $500,000 and $1,500,000 was provided each year under the program which ended in 1979. During the years the program operated, a total of $10.6 million was granted to industry. CPAR directly resulted in some major improvements in the pollution control technology used within the pulp and paper industry. Even a very brief review of the international literature on pollution control technology in the pulp and paper industry reveals the importance of the CPAR program in contributing to a worldwide understanding of the pollution reductions that can be achieved through the appropriate use of modern technology.

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[41] Corporation Taxation Statistics, Statistics Canada Industrial Organisation and Finance Division, Catalogue No. 61-208, 1983, and information gathered by the Finance and Administration Branch of DOE.

c) Development and Demonstration of Pollution Abatement Technology

The DPAT was announced by the Minister of Environment in April 1975. This program was designed to stimulate the development and demonstration of new abatement technology within the pulp and paper industry. The intention of the program was to demonstrate the feasibility of using such technology, but did not include within it any provision for research. It was a shared cost program with industry, whereby the Federal Government would provide up to 50 percent of the cost of a project depending on the risk involved and the potential benefits. Industry and government together spent approximately $14 million under the terms of this program. The government's share of the total expenditure was slightly over $3 million.

d) Demonstration of Resource and Energy Conservation Technology

The DRECT is an industry-wide program that was initiated in 1979 for the purpose of developing and demonstrating systems or products to save energy. It is a shared cost program in which the Federal Government will provide up to 50 percent of the total estimated cost for equipment, buildings, installation, engineering and consulting services, and the design and patents for approved projects. It is an ongoing program which to date has resulted in a $200,000 grant to one pulp and paper mill in Quebec.

e) Pulp and Paper Modernisation

The PPMP was initiated in 1979, and approved in principle by Treasury Board on May 2, 1979. The purpose of the program was to encourage the modernisation of pulp and paper facilities with a view to reducing production costs; encourage the installation of equipment that would help protect the environment and conserve energy. It was a government and industry shared program, whereby the provincial and federal governments shared not more than 50 percent of the total investment made by industry on approved investments. This program was set-up under a system of agreements with each of the participating provinces. Quebec, Ontario and each of the Atlantic provinces participated in the program. British Columbia and the Prairie provinces did not. Under the auspices of this program approximately $3.1 billion was invested in the pulp and paper industry. The Federal Government's share was close to $276 million and the provinces contributed $241 million. Roughly eighteen percent of the total investment, or $120 million, was (or will be) spent on pollution abatement. Although the vast majority of the grants tentatively approved under the program have been allocated, some projects were delayed due to regional economic circumstances. The program ended in Ontario in 1984, Quebec, New Brunswick and Nova Scotia terminates during 1988, and the program will remain in force for Newfoundland to 1991. The pollution abatement reductions achieved as a result of this program has been mixed. Nonetheless, it is felt 30 to 40 percent reductions in effluent discharges were achieved at some mills as a result of the PPMP. In many cases, toxicity levels were reduced.

Different Perspectives on the Pulp and Paper Effluent Abatement Regulations

Even though the regulations and the program initiatives that have been established for the pulp and paper industry are well founded conceptionally, over the years they have been subjected to a substantial amount of criticism by both industry and certain segments of the public. Spokespersons for industry often criticise the regulations by arguing that the Federal Government should leave the responsibility for industrial pollution control to the provinces.[42] Industry generally argues that the federal requirements are overly stringent. The criticisms are most pronounced when economic conditions are poor. In contrast to industry, the public supports a strong federal role in pollution abatement.[43] Most public dissatisfaction is directed at what many Canadians feel are regulations that are not tough enough on industry. It is frequently argued that existing regulations tend to favour unclean mill operations. Most of this criticism, whether from industry or from public, results from three provisions that are considered necessary to ensure fairness, and facilitate a spirit of cooperation between industry and government when the regulations were first developed. These are: (1) a federal presence which ensures the even handed nation-wide application of minimum standards of performance, (2) the use of standards which are based on technical capability of the mill rather than on the assimilative capacity of the surrounding environment, (3) the use of standards that focus on internal controls rather than external treatments. Each of these are discussed in what follows:

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[42] Jack Davis, Setting Standards Under the New Fisheries Act, Press Release by the Department of Fisheries and Forestry, Vancouver, October 3 1970, pp.9-10.

[43] Improved Program Delivery, Report to the Task Force on Program Review, Canadian Government Publishing Services, Ottawa, 1986, pp.16 & 18.

Federal Administration of Nation-wide Standards

There were 121 pulp and paper mills operating in Canada in 1970, when Mr. Davis first announced his intention to establish pollution abatement control standards for industrial sectors nation-wide. The pulp and paper industry was then, as it remains today, a major industrial component in six of ten provinces, and nine of the ten provinces had at least one mill. In some provinces, the only pollution legislation was the Federal Fisheries Act.[44] In other provinces, there often was limited enforcement of the legislation that was in place. As a result, the pollution abatement standards established for the pulp and paper industry have enjoyed the support of the Canadian public from the time they were first introduced.

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[44] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, June 8 1977, L. Edgeworth, p.29:33.

Industry spokespersons often argue that industrial pollution is a provincial responsibility and that the Federal Government should abandon their efforts in this area in favour of provincial controls. As referred to in Chapter Two, the basic tenure of this argument is that pollution is a regional problem which should be addressed by local or regional authorities.[45] Aside from the fact that this position ignores the desirable aspects of having even-handed control over industrial waste discharges nation-wide, it also ignores the fact that the Federal Government has some distinct responsibilities with respect to national health, the north, transportation, and international boundaries which require a federal presence. More importantly, the Canadian public is not concerned with jurisdictional niceties. When industrial waste discharges are perceived as disruptive or threatening, Canadians demand an appropriate response from both federal and provincial environmental authorities.

Standards Based on Technology

The original intent of developing standards which were technically based was to allow for regulations that could be applied nation-wide, without placing a disproportionate burden on mills in specific locations, using particular processing techniques, or producing certain types of products. The task force, made up of federal officials, representatives of industry, and officers from the provinces, recommended in support of the Minister of the day that technology based regulations should be adopted, because the use of the assimilative capacity would require data and knowledge that was not always available. However, during the more than sixteen years since the regulations have been in place, industry has complained that mills in one location often are allowed higher levels of discharge than another. They argue that the standards are continually changing and becoming more restrictive as new processes are adopted. Most importantly, because it was not intended when the regulations were first adopted, an opinion often voiced by industry is that standards which change with the introduction of new equipment and processes discourages the introduction of new technology in the industry.

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[45] A brief sent to the Honourable Jack Davis by the Council of Forest Industries, 1970, referred to by Mr. Davis in a speech to the Fraser Valley Regional Conference, October 3 1970.

As would normally be anticipated, individuals representing certain segments of the public take a somewhat different view in their criticisms. Their arguments are that the standards based on best practicable technology tend to favour industry. Those mills with higher waste discharges tend to benefit most from this type of regulation. It is further argued that controls based on technology do not provide the protection necessary to safeguard wildlife and fish habitat to the degree necessary to protect public interest.

When each of the foregoing criticisms are examined in turn, it can be argued that despite some obvious shortcomings, the benefits of using technology based regulations outweigh the disadvantages during the early years after the regulations were introduced. As originally intended, the regulations are minimal standards, which can be met using what were agreed upon as the best practicable technologies available in 1971. Standards based on the best practicable technology available worked to the collective advantage of industry for most of the years since 1971, because the regulations were set so that the environmental controls required were appropriate to the technologies available. In other words the environmental controls adopted were appropriate to the processes used within the industry, and could be employed without imposing the economic hardship, which could have resulted from having to adopt unproven control techniques. As new processes and processing technologies have been introduced over the years, there probably has been a growing gap between the control measures available for mills using newer processes, and those available for mills using the more established processes. This is not an argument that supports the view that the regulations discriminate either geographically or by process. All mills are subject to the same set of standards as laid out in the current regulations. Nonetheless, it is an argument for upgrading the regulations to take account of the best practicable technologies available in 1988.

The second criticism put forth by industry, viz., that the standards are changing and becoming more restrictive over time, is of somewhat questionable merit. The standards have not been changed since first adopted. What has changed is the plant equipment and processes used. As new equipment and processes are introduced, waste discharge requirements as set out under the regulations often become more stringent. This is consistent with the concept of best practicable technology, and is what was intended from the outset. The basic premise behind this approach is that Canadians are entitled to a clean environment, not that industry has a right to discharge waste. The gradual reduction in discharge limits that results from changes in production equipment or processes within a mill, allows the industry time to adjust to changing technology. It allows industry to systematically introduce pollution controls into their production process over time. As such, standards that are based on production technology should be perceived as a cooperative approach by government, not as an impediment to industry.

Somewhat more difficult to assess is the view put forth by industry that technology based regulations discourage industry from adopting new, more modern production techniques. This view is based on the fact that a mill using older equipment, and perhaps outdated processes, might meet federal discharge standards until processing facilities are upgraded. When new equipment is introduced and production processes are upgraded, consistent with the provisions implicit in the regulations, the discharge limits are reduced so that instead of being in compliance the mill might be operating beyond the prescribed limits. It is claimed that this discourages mills from introducing new operating techniques. Although this is largely an empirical question, it is difficult to believe that industry management make decisions on the equipment or processes they will adopt on the basis of new regulations that might be imposed on them as a result of environmental regulations. Firstly, no pulp and paper mill ever has been permanently closed down because of not complying with regulations. If a mill were to permanently close it would be the result of grossly exceeding discharge limits that were considered a threat to fish, wildlife, or human health, and because no effective remedial action is likely to be taken within an appropriate time-frame. Secondly, the government has never interfered with the right of management to decide on production processes used within a mill. Thirdly, over the years, the government has offered incentive to industry to purchase new equipment which would reduce waste discharges, either through tax concessions or direct financial grants as outlined above. Fourthly, as the processing technologies improve and are adopted, so do the technologies available to control wastes. Since it can safely be assumed that most mill operators make their investment decisions with an eye to the balance sheet, it is doubtful that investment in new technology has ever been abandoned, or even delayed, as a result of fear that such investment would result in more restrictive discharge requirements.

The concern that federal pollution abatement standards that are based on technology tend to favour industry is valid to some extent. There is little doubt that the natural capacity to assimilate waste in some localities is greater than in others. Some ecosystems are more sensitive than others. Thus, the standards as applied to mills located in more environmentally sensitive areas will enjoy an advantage over mills located in less sensitive areas. However, federal standards no matter how stringent, would not necessarily provide adequate safeguard for the fish and wildlife in every location throughout Canada,[46] unless they are used in conjunction with regional initiatives which allow for the use of more restrictive standards when appropriate. By adopting minimal standards, the Federal Government did allow for variations in assimilative capacity, however, it was also intended that federal regulations would be used in conjunction with other mechanisms (i.e. on-site inspection) and local environmental authorities to reduce the introduction of industrial waste when such controls were necessary. Therefore, a considerable amount of discretion has to be exercised by those responsible for enforcing federal national regulations, to ensure adequate protection in each location, and at the same time ensure equitable application under the law. There is nothing implicit in the regulations which necessarily favours more environmentally disruptive mills.

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[46] It is sometimes the very fact that waste discharges have been reduced which results in the natural introduction of fish into a confined waterway, and subsequently to fish kills, because of unanticipated accidental spills. See A.R. Thompson, "Water Law - The Limits of the Management Concept", Environmental Law in the 1980's: A New Beginning, Proceedings of Symposium held by Canadian Institute of Resources Law, Banff, 1982, pp.45-46.

This review on the implications of using technology based regulations does reveal an element of validity to both those who oppose their use and those that support them. The use of technology based regulations undoubtedly did provide some advantages during the early years after the regulations were first introduced, but the continued exclusive use of technology based regulations may not be appropriate for the future.

Internal Versus External Controls

While industry has been supportive of the Federal Government's use of internal controls, the same has not always been true of the public at large. Certain segments of the population view internal controls as overly generous to industry in terms of the time necessary to introduce environmental protection measures. While there appears to be little doubt that external treatment facilities can be put into operation more rapidly than production techniques can be changed, it also is true that most of the arguments used when the regulations were first introduced to support internal, as opposed to external, controls were appropriate to the circumstances of that time. The argument put forth then, in support of internal controls, was that such controls protect the integrity of the environment by encouraging the treatment of waste before it leaves the inside of the factory. This approach discourages mill operators from considering even the most minute amount of waste discharge as acceptable. In other words, when first introduced, it was meant to encourage industry to cooperate by fostering a "clean plant mind set" rather than one that was based on the arbitrary view that some discharges outside of the factory were acceptable if catch basins were in place and the capacity of surrounding area to assimilate waste was deemed sufficient.

The experience that has been acquired over the years since 1972 indicates that given a choice between internal controls and external treatments, the selection of internal controls was appropriate for federal regulations at the time the regulations were introduced. The combined use of both internal and external controls in the regulations probably would have detracted from the somewhat more urgent need (in the 1970's) to adopt in-house practices and processes, which appears to have resulted in the development of technologies that offer considerable long-term benefit. The use of internal controls helped to avoid some of the risks associated with unexpected spills from collection basins containing high waste concentrations. The risks of unexpected spills can be reduced through the use of low rate systems that involve longer holding retention periods.

However, longer retention periods also cause some problems because of unpleasant odors and unattractiveness, when located in publicly accessible areas.[47] There is as well the problem in Canada with the generally cold winters. The widespread use of aerated lagoons may not have been as effective as internal controls for some processes and in some locations. Furthermore, it is often argued that internal controls encourage the use of more modern up-to-date technology which helps to maintain the competitiveness of Canadian industry.[48] When all these matters are considered against the circumstances that existed in the early 1970's, the choice to place emphasis on internal control was probably appropriate.

Nonetheless, it can be argued that external treatments do represent the best in practicable technology for newly constructed mills, where these developments can be built relatively inexpensively and operated in conjunction with internal control technologies. This does not suggest that they are needed in all situations, or that an across-the-board requirement for these types of treatments is necessary or appropriate for all existing mills. There are some mills that will be able to meet standards solely through internal modifications, but there are as well many mills that will not be able to meet standards using only internal controls. In those situations where internal controls are inadequate, there is a need for the use of external treatments to help ensure the right of the public to a clean environment. This suggests that external treatments should be applied and enforced, when needed. The emphasis of the federal environmental authorities should be on meeting the standards and protecting fish and not on the control and treatment technologies that are to be used.

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[47] Those enforcing environmental regulations are often caught between what the public perceives as pollution and what is actually environmentally disruptive. As noted in Chapter Two, the use of external treatments to reduce toxicity and colour problems often adds to the odor problems generated by a mill. One can only speculate on the frustration this imposes on mill operators when they have spent thousands of dollars to reduce the problems associated with toxicity and colour, only to have the number of complaints from residents in surrounding areas increase as a result of odor.

[48] This is the view of Swedish government environmental officials as noted by Norman Bonsor, Neil McCubbin, and John B. Sprague, Stopping Water Pollution At Its Source: Kraft Mill Effluents in Ontario, report prepared by Expert Committee on Kraft Mill Toxicity for the Technical Advisory Committee, Pulp and Paper Sector of MISA, Ontario Ministry of the Environment, Toronto, April 1988.

The intention here is not to suggest that the total of the criticisms directed at the regulations have no substance; neither is it to indicate that all criticisms are valid. The regulations as first adopted were appropriate to the circumstances of the times when they were established. At the time the regulations were formulated, most provinces did not have industry pollution control legislation. By declaring that pollution havens were unacceptable, Mr. Davis was reinforcing the right of all Canadians to live in a pollution free environment.[49] By allowing "old mills" time to adjust to the new regulations, the regulations themselves implicitly avoided some of the hazards which could have arisen as a result of placing a disproportionate burden on mills producing some products or using certain production processes. The concept of fairness was reinforced by opting for the recycling of waste within the factory fence rather than depending on the locationally sensitive concept of assimilative capacity. The approach used provided a framework for better cooperation among environmental agencies and between government and industry. By adopting what were meant to be minimum standards, provincial environmental authorities were left free to develop legislation that was appropriate to local circumstances. The emphasis placed on internal controls encouraged industry to cooperate by adopting new, more efficient, and environmentally cleaner production techniques over time.[50] Overall, these principles placed a substantial amount of faith in what has been found to be a well-founded concept: that by working together industry and government can have both good economic growth and a clean environment. In fact, it could be argued that the basic principles adopted by government were consistent with the division of powers implicit within the Canadian federal system.[51] They are sympathetic but not overly generous to industry, and assertive in the right of Canadians to a clean healthy environment regardless of where they may live and work in Canada.

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[49] The term "pollution haven" as used throughout the remainder of this report is defined as a geographic area or region in which it is considered economically attractive to locate a manufacturing operation, or to invest in such operations, because of the advantages associated with not having to meet the same standards of pollution control that apply elsewhere.

Administrative Difficulties of Enforcing the Regulations

The pulp and paper regulations were designed to reduce the amount of waste discharged from the industry in Canada in a manner that is equitable to those being regulated and fair to those who depend on the industry for their livelihood. In terms of the Fisheries Act, and on the basis of what is prescribed in the regulations, this would seem a straightforward task. New or expanded mills are to be in compliance, existing mills will be required to meet effluent compliance standards as they expand or new technology becomes available. Mills that do not conform will be prosecuted. Unfortunately, the actual enforcement of the regulations is far more complex. The problems encountered by those responsible for administering the enforcement of the regulations are substantial. There are jurisdictional ambiguities, definitional uncertainties, legal difficulties, technical limitations, and discretionary dilemmas that together make the straightforward enforcement of regulations difficult. These difficulties are assessed in what follows.

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[50] As noted in Chapter Two, the Canadian pulp and paper industry has made significant advances in internal control modification technology. The Canadian performance in this area over the past fifteen years suggests that the emphasis on these types of controls was not inappropriate.

[51] Alastair R. Lucas, "Natural Resource and Environmental Management: A Jurisdictional Primer", op. cit., ed. Donna Tingley, pp.31-43.

Paradoxically, the difficulties associated with overlapping jurisdictional responsibilities are both disruptive to enforcement and overstated as a problem by those concerned about government process. There is little question the use of the Fisheries Act, as the legislative basis for enforcing industry effluent regulations, poses some problems for those federal officials responsible for enforcement. The primary purpose of Section 33 of the Fisheries Act is the conservation and protection of fish and fish habitat. The management responsibilities for fisheries in Canada is divided between the federal and provincial governments.[52] Very roughly, the responsibilities for inland fisheries are vested in the provinces and the authority for sea coast fisheries rests with the Federal Government.[53] Thus, the enforcement of effluent regulations based on legislations specifically designed for the purpose of fish management carries with it the implication that the responsibility for the enforcement of pulp and paper effluent regulation should or could be divided in the same way as the enforcement of the Fisheries Act itself. As such, the provinces could be assumed to have authority for enforcing regulations for those mills located in inland areas, with the Federal Government having responsibility for the enforcement of regulations for seacoast mills. As a consequence, there is considerable latitude for disagreement over which level of government has the primary responsibility for enforcing regulations in inland areas.[54] The potential for conflict has been considerably reduced because of the explicit or implicit working arrangements between provincial and federal environmental authorities. In most circumstances, questions of authority never arise because the two levels of government agree on the approach that should be adopted when dealing with polluting mills. In some situations, the sensitivity that each level of government has towards the other are such that mutually acceptable arrangements can be made that satisfy the priority concerns of both. However, there is little question that differing policy priorities in each province, and the varying working arrangements that are in place in each region, do somewhat detract from the uniform enforcement of the regulations across Canada.

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[52] P.C. Thompson, "Institutional Constraints in Fisheries Management", Journal of the Fisheries Research Board of Canada, Vol. 31(12), 1974, p.1979.

[53] In practice, the division of responsibilities for fisheries is somewhat more complicated. The division of authority often is based on the species being managed. For example, it is frequently asserted that federal authority is limited to anadromous fish. However, even this dilineation does not hold true in all cases. See: Richard Parisien, The Fisheries Act: Origins of Federal Delegation of Administrative Jurisdiction to the Provinces, Ottawa, 1971, 36p.

The use of the Fisheries Act as the legislative base for effluent regulations also results in some inconsistencies with respect to enforcement over time. The Federal Government originally intended the use of the Fisheries Act and the subsequent industrial pollution regulations as the principle means for protecting the environment. The Minister of the Environment who was also statutorily the Minister of Fisheries, stated at the time the amendments would allow for the establishment of industrial pollution regulations were necessary to "cope effectively with the mounting pollution problems from modern industry" and at the same time would strengthen the ability of the Federal Government to protect fish and marine life.[55] The Minister added that "as a general rule, water that is good for quality fish signifies a sound aquatic environment".[56] Thus, there was a shared focus on fisheries protection and the environment in general. However, this shared emphasis on fisheries and the environment shifted in 1978, when the new Department of Fisheries and Oceans was established and became responsible for administering the Fisheries Act. Even though DOE continued to administer S.33 of the Fisheries Act through mutual agreement, the use of the Act itself resulted in dividing the focus of Environmental Protection personnel between fish (which is the primary responsibility of DFO) and the more general environmental concerns that are the responsibility of DOE.[57]

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[54] Federal environmental authorities can use the more general provisions of S.33 of the Fisheries Act to enforce the standards specified under the regulations in non-coastal areas, but such action would be contrary to the cooperative approach which has been in place for many years.

Understandably, DFO with its distinct and clear mandate for fish is less concerned with pollution abatement standards, than with the effect of pollution (even though the polluting mill might be in compliance with the standards) might have on fish.[58] Over the years, this has led to some disagreement between DFO personnel (who greatly outnumber EP enforcement personnel) and EP enforcement personnel. It also has resulted in greater emphasis on enforcing standards for mills located in areas where the Federal Government has the exclusive responsibility for fish. This in itself does add to the difficulty of ensuring even-handed enforcement of the regulations in all parts of the country.

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[55] Minutes of Proceedings and Evidence of Standing Committee of Fisheries and Forestry, April 30, 1970, p.19:8.

[56] Ibid., pp.19:8-9.

[57] A distinction which is consistent with the Government Organizations Act is that DFO is responsible for fish using the protection of water as a means to that end, and DOE is responsible for the environmental quality of the water through the protection of fish.

[58] The reader will recall that the standards are minimum requirements which are technology based rather than assimilative in nature. As such, the standards do not absolutely assure the total protection of fish in environmentally sensitive locations under all circumstances.

While the use of the Fisheries Act as the basis for the pulp and paper effluent regulations and overlapping jurisdiction are the cause of some administrative difficulties for EP personnel, these difficulties are often overstated. It is important to recognise that overlapping responsibilities have never prevented any agency (whether federal or provincial) from acting unilaterally in laying charges against a polluting mill under the appropriate legislation. The provinces, DFO, and EP all have exercised their recognised right to proceed with legal action under existing federal and provincial legislation when deemed appropriate. This has resulted in the disproportionate use of some aspects of existing legislation in some jurisdictions, but it has not, as claimed by some industry officials, led to unfair or inequitable treatment under the law.

The evidence for both disproportionate emphasis on some aspects of existing legislation and on the inherent fairness of the level of enforcement among industry components are at least partially revealed by an examination of attempted prosecutions. For example, during the period 1970 to 1976, inclusively, over 80 percent of all prosecutions under Subsections 33(2) and 33(3) of the Fisheries Act against pulp and paper mills took place in British Columbia.[59] However, during the period 1968 to 1983, the federal and Ontario governments together and separately pressed charges against fourteen pulp and paper mills in Ontario. During that same period the federal and British Columbia governments together and separately prosecuted eighteen pulp and paper mills.[60] Critics might point out that comparisons based on the total number of prosecutions are invalid, because Ontario has more pulp and paper mills than British Columbia. Under the circumstances, it would be expected that equal application of the law would result in more prosecutions in Ontario than in British Columbia. This appears reasonable, except the mainstay of British Columbia's valuable fisheries resource is the anadromous salmonid species, which for various stages of their life live in two major rivers, over three thousand streams, countless lakes, and in every one of British Columbia's many estuaries. When all of these factors are taken into account, the difference in prosecutions appears insignificant and reveals no obvious locational difference in the treatment of pulp and paper mills.[61] In fact, it could be argued that this information, consistent with what was intended when the regulations were first adopted, is evidence of cooperation between the two level of governments rather than unfair enforcement.

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[59] Fisheries Pollution Reports: Prosecutions Under the Pollution Control and Habitat Protection Provisions of the Fisheries Act, July 1984. Other information was taken from files provided by Environmental Protection Headquarters in Ottawa.

[60] The reader should note that the comparison between Ontario and British Columbia was used because the information from these provinces is available. Similar information is not available for other provinces. The information used here is based on attempted prosecutions and not necessarily on successful litigation.

[61] Similar comparisons on the basis of capital expenditures on pollution abatement controls are provided in Chapter Four. These comparisons, similar to the comparisons on prosecutions provided here, reveal no locational difference among pulp and paper mills under existing environmental legislation.

It also can be argued that the joint administration of the Act provides the public with assurance that such legislation will be enforced when appropriate. It ensures that the agencies involved will thoroughly review the circumstances surrounding each individual hazardous discharge, while taking into account the views of all other environmental regulating agencies in a region. This provides some minimal guarantee that each agency will act with appropriate dispatch, and in a responsible manner, knowing that their efforts are of concern to others with direct responsibilities for dealing with the consequences of industrial pollution. Instead of being perceived as administratively wasteful, this very limited overlapping responsibility should provide industry and the public with a great deal of comfort, knowing that no single authority can with absolute impunity decide on what ultimately constitutes a safe, clean environment.

Perhaps the most problematic aspect for those responsible for enforcing the pulp and paper effluent regulations result from the tiered approach that was built into the standards in an attempt to avoid disproportionate regulatory impact and allow for gradually bringing all mills under the regulations over time.[62] As previously noted, the regulations require that new mills (mills that came into existence subsequent to November 26, 1971) were to meet the standards in the regulations immediately upon going into operation. Altered or expanded mills were to meet standards once modifications were completed. Existing mills (those in operation prior to November 1971), which were given time to adjust, were not under the regulations. The main difficulty for administrators is that the existing mills which constitute the majority of operating mills in

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[62] Huestis, op. cit., p.113.

Canada, have never been brought under the regulations. Until the regulations are proclaimed in force for existing mills, the regulations represent little more than guidelines that cannot be used except in what is a most circumspect manner to impose compliance on older mills. Thus, the regulations that were meant to be applied even-handedly across the industry cannot be enforced in such manner. Older mills, which because of high investment costs, and what amounted to an "after the fact" legislative change in the rules, generally are treated more leniently than other mills.[63] The logic of this approach was irrefutable in terms of the obvious need to protect a well established, long-standing, and valuable industry from the potential damages that could result from abrupt changes in the rules. However, the wisdom of this approach in light of the enforcement complexities, legal limitations, and knowing when all mills should be required to meet the standards is not so clear.

Related to the tiered system of enforcement implicit in the regulations is the definitional problem of knowing when a modified mill should be considered an expanded or altered mill under the regulations. As defined in the regulations, an altered mill is a mill that due to changes in production processes alters the quality of the effluent from the mill, when such changes are not made solely for the purpose of pollution abatement. An expanded mill is a mill which installs equipment and increases production of the mill by ten percent or more. On the basis of these definitions, it is difficult to conceive of a situation where a mill could be considered expanded or altered, unless its production increases by ten percent or more and it is not for the purposes of pollution reduction. Further difficulties arise out of the fact that most mills do not increase output immediately upon modification. Increases in production usually occur incrementally over time, as the "bugs" in the production system are eliminated. Furthermore, in many cases, alterations to existing facilities result in some pollution reduction. Thus, what appears to be a rather straightforward interpretation of the regulations is actually complicated and difficult to assess. As a result, the enforcement of the regulations becomes even more difficult to apply in a straightforward and even-handed manner.

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[63] It should be noted that Canada's pulp and paper industry, like other industry in Canada, usually acts in accordance with the publicly accepted standards of the time. The pulp and paper regulations established in 1971, did not of themselves make waste discharges dangerous. Accordingly, the government did not place an undue economic burden on industry by over-reacting to a situation that had existed since the first pulp mill was established in Quebec in 1864. The government did what most would consider reasonable under the circumstances. They declared industrial pollution unacceptable by stating that industry would have to share in the cost of reducing pollution that they generated, and established a framework to protect and rejuvenate the environment over time.

The problems associated with interpreting when each mill should be subject to the regulations has resulted in four different enforcement standards categories, that can be applied on the basis of individual circumstances. All mills in Canada are subject to the general provisions of Section 33 of the Fisheries Act. As shown in Table 3:1, eleven mills in Canada are subject to the regulations, because they are new mills built since November 1971. Another 39 mills are considered expanded mills, and one mill in British Columbia is included under the altered category. In total there are 51 mills in Canada, representing 42 percent of the nation's total discharge mills, that can be interpreted as being subject to the pulp and paper regulations. As laid out under the regulations all new mills are subject to the regulations. However, only the expanded or

TABLE 3:1

NEW, EXPANDED AND ALTERED MILLS IN CANADA AS CAN BE INTERPRETED UNDER THE PULP AND PAPER EFFLUENT CONTROL REGULATIONS ACCORDING TO REGION - 1986

	New		Expanded		Altered	
	#	%	#	%	#	%
British Columbia	3	27.3	6	15.4	1	100.0
Prairies	1	9.1	0	0	0	0
Ontario	0	0	14	35.9	0	0
Quebec	5	45.5	11	28.2	0	0
Atlantic	2	18.2	8	20.5	0	0
Canada	11	100.0	39	100.0	1	100.0

Source: Environmental Protection, Headquarters, Ottawa 1987.

altered portion of existing or older mills, that have increased their output by ten percent or more for purposes that do not relate directly to pollution abatement control, are subject to the same regulations. Not only is it difficult to determine the amount of expansion that is for mainly pollution control, but in fact it is almost impossible to achieve total agreement on what discharge limits should be applied at expanded or altered mills on the basis of proportional reductions in total mill effluent. Although EP personnel have attempted to clarify the legal interpretation of the regulations through requesting legal advice, such advice is of limited value until interpreted in the courts. Since EP personnel are reluctant to proceed with prosecution under the regulations, because of the uncertainties associated with legal interpretation, the regulations have never been clearly interpreted in the courts.

Other enforcement difficulties are encountered as a result of those provisions specifically designed to ensure fairness and application in the regulations. As previously noted, the pulp and paper effluent regulations were established as minimum standards that were to be applied uniformly across Canada, without distinction to mill type, process, or location. While this approach is appropriate to the main goal of avoiding pollution havens and ensuring sufficient flexibility to deal with exceptional situations, it also make it difficult to apply the regulations in a way that assures equitable enforcement. As noted in Chapter Two, some pulp and paper producing processes are more adaptable to the introduction of modern and less polluting technologies than others. Some mills are located in more environmentally sensitive locations than others. EP, as the federal lead agency responsible for the industry pollution, has no choice but to place greater attention on mills where pollution poses the greatest threat to the ecosystem, regardless of the process being used. Therefore, by virtue of the way the regulations were specified and the legal requirements under Section 33 of the Fisheries Act, those responsible for enforcement have to balance the capacity of a mill to adopt new cleaner production processes against the amount of risk imposed as a result of waste discharge. So even though the regulations do not explicitly take into account assimilative capacity, as a matter of practical necessity, the weighing of environmental risk against the capacity of a mill to adopt cleaner processes requires an implicit regard for the assimilative capacity of the local ecosystem as well as the best practicable technology that might be applied.[64]

Both assimilative capacity and best practicable technology are difficult to measure and even more difficult to apply. To some degree, the difficulties associated with measuring assimilative capacity are revealed by the fact that they were not used in the regulations when first adopted, because of the imprecision inherent in such a concept. It is not only difficult to define, but if explicitly included as a basic requirement for enforcement, it would be expensive and time consuming to apply. Not only does assimilative capacity require knowledge about the ecosystem that is not always available or understood, but more often than not it is controversial and not fully scientifically defined.

Unfortunately, best practicable technology suffers from the same lack of precision that can be ascribed to assimilative capacity. Best practicable technology is in fact technology deemed practical for use by the management of a mill acting in the best interests of the owners and shareholders and is acceptable to environmental agencies. While it may appear to have precise definitional precision, it is difficult to envision someone not directly involved in the operation of a mill telling those responsible for mill production that other technological processes are more practicable. Best practicable technology is not necessarily the best technology available; it is not necessarily the most efficient technology available. More realistically, it is the best technology available given the economic realities of the mill, the market strength of the mills products, and the commercial viability of the processes it will be adopting for use over time. As such, it is a concept that cannot be measured, because it is continually changing and ultimately depends directly on the goals of those operating the mill over the long-term future.[65]

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[64] It is not surprising, therefore, that British Columbia with its very important anadromous fisheries accounts for a very high proportion of the total prosecutions under Section 33. (See p.200).

The practical difficulties associated with tiered enforcement, the weighing of risk, and definitional uncertainties have been addressed to some extent through the use of negotiated compliance schedules. Whenever a mill is not in compliance, and the circumstances are such that the obligations under the law cannot be readily enforced, a negotiated settlement over the controls necessary and the time required to implement the controls is undertaken. These are in fact informal agreements that are either negotiated directly by EP, or are endorsed by EP and included as part of provincial compliance schedules or control orders. At least in theory, the incentive for industry to enter such agreements is that adherence to the terms of the agreement will render a mill immune from prosecution.[66] As the regulating agency, the benefit to EP is that it encourages industry to cooperate without resorting to the courts.[67] The main disadvantages to these agreements are twofold. The first is, that to a very large degree, the information on which these agreements are based depends directly on the willingness of industry to supply accurate facts and figures.[68] The second is that the agreements themselves are not always binding in law.

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[65] J.W. Parlour, "The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970", Journal of Environmental Management, Vol. 13, 1981, p.142.

The problems associated with obtaining accurate information are substantial. When mill operators are involved in negotiating a compliance agreement, understandably they wish to make the best possible arrangements from their point-of-view. Consequently, they often are less than completely forthright in providing information about their operations.[69] They frequently argue that the costs of adopting the appropriate control standards within a specific time-frame are prohibitive. They sometimes claim that the affect on the economic viability of their operation will be unacceptable.[70] Without total access this information, those involved in the negotiations representing environmental interests often have little choice, but to acquiesce to industry's sometimes very persuasive arguments about the damage that would be done to their economic interests.[71] Under such circumstances, the alternative would be to undertake costly and time consuming investigations that may not provide definitive answers.[72] The same is true when mills fail to act in accordance with a compliance schedule. When a mill operation fails to live up to the terms of a control order or compliance agreement, the EP has two choices: to renegotiate, or prosecute. When an EP sponsored provincial compliance schedule is involved, a third possibility exists. This involves encouraging provincial authorities to enforce the terms of the agreement. However, as already implied above, the decision to enforce adherence to compliance agreements is fraught with legal uncertainties, regardless of who initiates court action.[73]

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[66] Kernaghan R. Webb, Industrial Watch Pollution Control and the Environmental Protection Service, prepared for the Law Reform Commission of Canada, May 1983, Chapter 5(R)P:(ONE) p.92.

[67] Huestis, op. cit., p.122.

[68] The Federal Treasury Board requirements for Regulatory Impact Analysis Statement (RIAS) referred to earlier, require an examination of the impact of both new legislation and amendments to existing legislation. The economic information, which industry is often reluctant to provide, is necessary for carrying out a RIAS.

[69] Information is often withheld because of the need of a company to protect their strategies from competitor scrutiny. See: Peter A. Victor, Terrance W. Burrell, Jim Evans, Charles Figuericedo, Environmental Protection Regulation: Water Pollution, and the Pulp and Paper Industry, Technical Report No. 14, Economic Council of Canada, Ottawa, August 1981 p.78.

There are as well the technical limitations associated with enforcement. As outlined earlier, the limits in terms of waste discharges are set out in the regulations on the basis of BOD, TSS, and acute toxicity. Mills in compliance with the regulations must not exceed this maximum preset limit for these three types of wastes. The measurements used to determine whether a mill is operating within these preset limits are established on the basis of the cooperative monitoring efforts of EP and provincial environmental authorities. The samples collected in the monitoring program are sent to quality control laboratories (usually in the mills themselves) which conduct tests in the manner prescribed under the regulations. Allowances are made for statistical error within certain probabilities to determine whether a mill is in compliance with the standards. Accepting that such tests are always subject to variance, this appears a fairly straightforward approach. Unfortunately, there is considerable variation in the levels of waste substances present in samples taken from the same mill through time.[74] A mill tested as being in compliance one day, may test as out of compliance the next. In fact, the variance of some mills with secondary treatment are often quite erratic.

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[70] A statement by representatives of the pulp and paper industry. Cited in Victor, et al., ibid.

[71] Mr. Marshall of the Standing Committee of Fisheries and Forestry expressed alarm about the fact that Abitibi-Price indicated that to comply with regulations would cost $50 million, and restrict the ability of the company to create more jobs. See: Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, Issue 29, June 8 1977, p.29:39.

[72] The heterogenious nature of the industry does not always allow for the accurate use of industry-wide calculations to assess the financial ability of individual firms or mills. Nonetheless, industry-wide averages can be used to indicate most mills' economic capacity to meet standards if adjustments are made for on-site and process differences.

[73] The one exception to this may be when a private citizen chooses to prosecute under the authority of the Fisheries Act. See: Webb, op. cit., Chapter 5(R)P:(ONE), p.91.

There are as well problems with the type of test required to determine toxicity. Averages can be taken to smooth out the patterns, and the time over which the averages are calculated can be extended to determine whether a mill is in general compliance. However, there remains considerable latitude for interpretation as to whether a mill is in general compliance. Thus, strict enforcement of the regulations, that are based on daily averages in kilograms of waste per tonne, could result in virtually every mill that is subject to the regulations being charged with exceeding federal pollution standards on any single day's sampling. As a consequence, those responsible for enforcement only proceed with prosecution in the most severe cases, when a mill is responsible for a spill due to negligence or is consistently violating the regulations and the operators are making little or not effect to meet pollution standards.

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[74] There are also problems because of the differences in the results obtained from static as opposed to flow through analysis. See: Appendix I.

The discretionary powers as to when mills should be included under the regulations are appropriate to the intended purpose of ensuring that unnecessary hardship is not imposed on the public. However, they also cause considerable controversy over how much time should be allowed for the industry to adjust before it is required to meet the regulations. Those not directly affected by the enforcement of regulations, and who can be assumed to have a sincere regard for the environment, demand immediate action. Those enforcing the regulations are often faced with the prospect that the enforcement of standards might affect the economic viability of a mill. The quandary for those responsible for enforcement is often exacerbated by the fact that the waste being discharged, even though it may be coloured and emit foul odor, sometimes does not pose any immediate threat to fish, wildlife, or human health. Yet, failure to proceed with prosecution, or an extension of the terms of a compliance schedule, often is perceived by certain segments of the public as industry having undue influence on government,[75] or even a silent conspiracy between government and industry to circumvent the law.[76] These critics ignore that government officials probably have decided against prosecution out of compassion for the hundreds, and sometimes thousands, of Canadians who could lose their livelihood as a result of overly zealous enforcement. Further, they are overlooking the possibility that what they might consider as arbitrary and inconsistent use of the law, is merely the exercise of the discretion which was intended by political leaders when the legislation was first adopted.[77]

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[75] T.F. Schrecker, Political Economy of Environmental Hazards, A study prepared for the Law Reform Commission of Canada, Ministry of Supply and Services, Ottawa, 1984, pp.59-70.

[76] A front page article in a national newspaper included the following observation: "An agency such as the Environmental Protection Service has such a close relationship with the companies it regulates that it 'has rarely chosen to prosecute even when violations have been detected,'...". Kirk Makin, "Most Laws Not Enforced, Legal Group's Study Finds", The Globe and Mail, Toronto, September 11 1986, p.1. Lorne Giroux, "Delegation of Administration", Environmental Law Centre, ed. Donna Tingley, op. cit., pp.84-92.

The Management and Administrative Accomplishments of the Federal Government

Even though the enforcement of federal effluent regulations are fraught with difficulties which impede the straightforward enforcement of standards, this does not necessarily mean poor or ineffective management.[78] In this regard, it should once again be emphasised that when the pulp and paper regulations were first adopted in 1971, most provinces had not developed the legislation or acquired the expertise necessary to deal with industrial pollution within their own borders.[79] Therefore, a major aim of the water pollution regulations, very similar to the guidelines subsequently established under the Clean Air Act, was to provide a core of specialists within the Federal Government which would interact with their counterparts in other environmental agencies and to encourage a cooperative approach for reducing industry pollution.[80] The need to work with other federal agencies, the provinces, and industry was central to the overall concept, which was envisioned at the time the regulations were developed.[81] It also was emphasised that it was intended that all mills would be brought under the regulations over time. The remainder of this Chapter will be used to assess the progress that has been made in establishing the administrative framework envisioned by Mr. Davis when the regulations were first adopted.[82]

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[77] Mr. Les Edgeworth, when discussing the problem in front of the Standing Committee on Fisheries and Forestry, stated: "...the cost of putting in pollution facilities, as you say, would be as much as the cost of the mill itself. It might be $100 million. Obviously that is not going to be done. So either the plant closes or they build a new plant." See: Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, House of Commons, Issue No. 29, p.29:39.

[78] Schrecker, *op. cit.*, p.64.

[79] Mr. Les Edgeworth in a statement to the Standing Committee on Fisheries and Forestry as recorded in the Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, June 8 1977, p.29:33.

The adoption of the regulations in 1971 marked a new era in environmental protection in Canada. For the first time, there were nation-wide targets for pollution reduction in an industry in Canada.[83] The onus for meeting these standards rested with those causing the pollution. The patchwork approach which had previously prevailed has been displaced by a cooperative administrative framework which is sanctioned by both the provinces and industry.[84] The uncertainty that had been a matter of such importance in the past, with respect to jurisdictional responsibilities of the federal and provincial governments, has become less of a distraction as a result of the cooperative arrangements that have been established. The systematic approach for the ongoing monitoring and testing of waste discharges has been established with the provinces and industry. Officials with government resource and environmental agencies meet more frequently to discuss the positive steps necessary to reduce the risk of waste discharges before they occur rather than focusing on the negative aspects of what is necessary for clean-up after a spill has already happened.

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[80] Ibid., April 30 1970, p.19:7 and March 10 1971, p.1:7.

[81] Ibid., April 27 1971, p.7:15.

[82] The specific goals of the Federal Pulp and Paper Regulatory Program are outlined and discussed in Chapter Four.

[83] H. A. Hosse, F. Beecroft, H.A. Lawless, E.G. Pleva, "The Multiple Use of Resources: Policy-making and Administration", The Pollution Reader, ed. Anthony DeVos, Norman Pearson, P.L. Silveston, W.R. Drynan, Proceedings of National Conference on Pollution and Environment held in Montreal, October 31 - November 4 1966, sponsored by the Canadian Council of Resource Ministers, Harvest House, Montreal, 1968, p.200.

[84] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, May 12 1970, p.22:62.

As a direct result of the regulations, virtually all provinces in Canada have established regulations and controls for dealing with pollution caused by the pulp and paper industry. Many of the provinces have used the federal pollution abatement regulations and the air emissions guidelines as a basis for establishing their own regulations. The Federal Government in cooperation with the provinces have negotiated informal compliance schedules with many mills in Canada. As originally intended, these schedules are negotiated with regard to the technical feasibility of the safeguards required, the financial burden on the company, and the economic circumstances of the community or region where the mill is located.[85] However, the test of how well these arrangements have served their intended purpose ultimately depends on: (1) the affect these arrangements have had on those being regulated, and (2) the value of these arrangements to those who jointly share responsibility for regulating the industry.

The industry's views on the amount of overlap among and between environmental agencies was gathered during the course of this study. Table 3:2 presents this information. According to the information contained in this Table, 22 percent of mill and industry representatives

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[85] Recorded in Hansard of House of Commons, November 9 1971, p.9473.

TABLE 3:2

PULP AND PAPER MILL AND INDUSTRY PERSPECTIVES ON AMOUNT OF REGULATIVE OVERLAP BETWEEN AND AMONG FEDERAL AND PROVINCIAL GOVERNMENT ENVIRONMENTAL AGENCIES ACCORDING TO REGION - 1987

	British Columbia		Ontario		Quebec		Maritimes/ Prairies		Canada	
	#	%	#	%	#	%	#	%	#	%
Too much overlap	4	36.4	4	33.3	1	5.9	2	20.0	11	22.0
Too much overlap in the past but not now	3	27.3	1	8.3	7	41.2	1	10.0	12	24.0
Too much overlap now but not in the past	0	0	0	0	0	0	0	0	0	0
Satisfied with both the past and present	4	36.4	2	16.7	9	52.9	6	60.0	21	42.0
No opinion	0	0	5	41.7	0	0	1	10.0	6	12.0
	11	100.0	12	100.0	17	100.0	10	100.0	50	100.0

Source: Industry and Provincial Agency Survey, 1987.

consider there to be too much overlap between and among government agencies. However, another 24 percent feel that there has been definite improvement in reducing the amount of regulative overlap during the time they have worked within the industry. Another 42 percent feel that overlap is not a problem now, and was not a problem in the past. Not unexpectedly, in terms of the information that is provided below in subsequent Tables, the greatest concern about regulatory overlap between government agencies was expressed by representatives of mills in British Columbia.[86] Nonetheless, even in British Columbia, 27 percent feel there had been a definite improvement in this area over time. Ontario mills continue to have concern about administrative overlap among government environmental agencies, and only slightly over eight percent offer the opinion that there had been any improvement from the past.[87] Despite these somewhat mixed results, 78 percent of all industry representatives are satisfied that there is not too much overlap among government environmental agencies.

The information presented in Table 3:3 shows those government environmental agencies, which mill representatives deal with on an ongoing basis up to and including 1986. According to this information, 66 percent of mills deal with provincial agencies, but some mills have direct dealings with EP federal personnel in all regions. As would be expected, interaction between EP personnel is greatest in coastal areas, because of the federal fisheries responsibilities. The industry's dealings with EP personnel is the smallest in Quebec, where it is felt that regulatory

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[86] It will become apparent, that there remains concern among B.C. mills about administrative overlap between DFO and EP personnel.

[87] The opinion expressed by Ontario mill officials was influenced by concern over the pending Municipal, Industry Strategy for Abatement (MISA), which was announced by the Ontario government in June, 1986.

TABLE 3:3

GOVERNMENT ENVIRONMENTAL AND RESOURCE AGENCIES THAT PULP AND PAPER MILL OR INDUSTRY REPRESENTATIVES DEAL WITH ACCORDING TO REGION[1] - 1987

	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada	
	#	%	#	%	#	%	#	%	#	%
Provincial Environment	11	44.0	11	91.6	17	94.5	9	52.9	48	66.7
Environmental Protection (Federal)	6	24.0	1	8.3	1	5.5	6	35.3	14	19.4
Federal Fisheries	6	24.0	0	0	0	0	2	11.8	8	11.1
Others	2	8.0	0	0	0	0	0	0	2	2.8
	25	100.0	12	100.0	18	100.0	17	100.0	72	100.0

[1] Sums do not necessarily equal the total number included in survey as officials often named more than one agency.

Source: Industry and Provincial Agency Survey, 1987.

overlap has reduced the most. It is highest in British Columbia where it is felt that administrative overlap remains a problem (See: Table 3:2), but has been reduced over time. Only 8.3 percent of Ontario mills indicate that they deal with federal EP personnel on a regular basis. Despite this small amount of interaction, mills in Ontario expressed considerable concern about continuing administrative overlap. On the basis of the information contained in Tables 3:2 and 3:3, it cannot be concluded that the level of federal presence is inappropriate to the intended purpose of the effluent abatement regulations. The smaller federal presence in inland areas might be considered suitable to the consultative processes which have been developed over time.[88]

The information in Table 3:4 shows the preferences of mill and industry officials in dealing with government on pollution abatement matters. According to this information, 45 percent of mill officials prefer to deal with provincial environmental agencies. However, it also shows that 51 percent of mill representatives and industry officials are either indifferent to which level of government they deal with, or feel there is a need for better cooperation between the two levels of government, on what were usually, enforcement matters.

Tables 3:5 and 3:6 are used to provide information on the relationship between federal personnel and industry. According to the information in Table 3:5, 65 percent feel that the federal environmental personnel were helpful. Another 23 percent feel that a federal fisheries

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[88] The effectiveness of intergovernmental arrangements ultimately depends on the pollution reductions actually achieved. This information is presented in Chapter Four.

TABLE 3:4

PREFERENCES IN DEALING WITH GOVERNMENT ENVIRONMENTAL AGENCIES BY PULP AND PAPER MILL AND INDUSTRY REPRESENTATIVES AS A PERCENTAGE OF THE TOTAL RESPONSE IN EACH REGION - 1987

	British Columbia %	Ontario %	Quebec %	Atlantic/Prairies %	Canada %
Prefers to deal only with Province	63.6	36.4	43.8	33.3	44.9
Indifferent to who they deal with	27.3	54.6	50.0	16.7	38.8
Want better co-operation between Province and Federal agencies	9.1	9.0	6.3	33.3	12.2
Prefer to deal with Federal Government (EP)	0	0	0	16.7	4.1

Source: Industry and Provincial Agency Survey, 1987.

TABLE 3:5

PULP AND PAPER AND INDUSTRY REPRESENTATIVES DESCRIPTION OF BEHAVIOUR OF FEDERAL ENVIRONMENTAL AGENCIES[1] IN ADMINISTERING ENVIRONMENTAL LEGISLATION AND REGULATIONS - 1987

	Number[2]	%
Helpful	39	65.0
Over-demanding or Restrictive	11	18.3
Bureaucratic	1	1.7
Antagonistic	2	3.3
Unfair	1	1.7
No Opinion	6	10.0
	60	100.0

[1] Of the 13 included in the "over-demanding or restrictive", "bureaucratic", "antagonistic" categories, 11 specifically stated that the Department of Fisheries and Oceans was the agency that they were referring to.

[2] Individual respondents sometimes referred to more than one category.

Source: Industry and Provincial Agency Survey, 1987.

TABLE 3:6

DESCRIPTION OF THE RELATIONSHIP BETWEEN FEDERAL ENVIRONMENTAL AGENCIES AND THE PULP AND PAPER INDUSTRY[1] ACCORDING TO MILL AND INDUSTRY REPRESENTATIVES IN EACH REGION - 1987

	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada	
	#	%	#	%	#	%	#	%	#	%
Excellent	0	0	0	0	0	0	2	18.2	2	3.5
Very Good	0	0	0	0	0	0	1	9.1	1	1.8
Good	5	31.2	5	41.7	12	66.7	1	9.1	23	40.4
Fair	3	18.8	4	33.3	0	0	3	27.3	10	17.5
Poor[2]	0	0	1	8.3	1	5.6	1	9.1	3	5.3
Very Bad[2]	5	31.2	0	0	0	0	0	0	5	8.8
No Opinion[3]	3	18.8	2	16.7	5	27.8	3	27.3	13	22.8
TOTAL	16	100.0	12	100.0	18	100.0	11	100.0	57	100.0

[1] Individual respondents sometimes referred to more than one activity category.

[2] All respondents that referred to the relationship between federal environmental authorities and industry as "poor" or "very bad" specifically identified The Department of Fisheries and Oceans as the reason for this opinion.

[3] "No opinion" does not necessarily mean no answer, only that their opinion was based on their relationship with provincial rather than federal officials.

Source: Industry and Provincial Agency Survey, 1987.

is "over-demanding", "bureaucratic", or "antagonistic".[89] The information contained in Table 3:6, indicates that the relationship between officials and industry personnel is generally fair or better. Although once again, 14.1 percent expressed concern over their relationship with federal fisheries.

When the information in Table 3:4 are compared with the information contained in Tables 3:5 and 3:6 it becomes clear, that to a very large degree the preference for dealing with provincial agencies is influenced by what many industry officials consider less than sympathetic treatment by federal fisheries personnel. Nonetheless, this generally favourable response by industry, when given an opportunity to comment anonymously on federal personnel, suggests that the cooperative framework which was originally intended has been fostered in a manner conducive to maintaining good cooperation between EP and industry.

Table 3:7 is used to present information on industry's view of the understanding that EP personnel have about the problems encountered by industry in controlling pollution. According to this information, 44 percent of industry representatives feel that EP personnel have a good understanding of industry problems. More than twenty percent are of the opinion that EP personnel do not understand the biological problems, and 50 percent feel that EP personnel did not have sufficient appreciation of finance or business. It should be noted that these industry observations are consistent with what might be anticipated as a result of the discussion and analysis presented in other sections of this report.[90] What

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[89] It should be noted that the terms used in the Table were those chosen by industry officials and not by those responsible for conducting this survey and preparing this study.

[90] For example, Chapter Two, pp.148-149, and Chapter Six, pp.454-455.

TABLE 3:7

NUMBER AND PERCENTAGE OF THIRTY-FOUR[1] RESPONDENTS THAT DIRECTLY COMMENTED ON FEDERAL ENVIRONMENTAL PROTECTION'S PERSONNEL UNDERSTANDING OF ENVIRONMENTAL CONTROL PROBLEMS CONFRONTING INDUSTRY - 1987

	Number[2]	%
Generally Understood Problems Encountered by Mills	15	44.1
Do Not Understand Problems Because of Insufficient Economic and Business Appreciation	17	50.0
Do Not Understand Problems Because of Insufficient Biological Appreciation	5	20.6

[1] The sample of thirty-four mills in the survey is equivalent to 27.6 percent of the target population of a total of 122 direct discharge mills in Canada.

[2] The response categories are not mutually exclusive. Some respondents felt both economic and biological appreciation was lacking. Others felt that the general understanding of their problems by EP officials was good, but at the same time, felt these same officials did not fully understand the total extent of the biological (and/or economic) impacts involved.

Source: Industry and Provincial Agency Survey, 1987.

in Chapter Two.[90] What appears to be more telling in terms of the ongoing administration of the program over time, is industry's apparent concern over the future implications of the existing regulations which will be discussed later in Chapter Five and Six.

Table 3:8 is used to present information on the views of industry and provincial environmental authorities on the changing attitude of industry towards environmental protection over the last ten to fifteen years. According to the information presented in this Table, more than three-quarters of industry spokespersons feel that there has been either good or very good improvements in the attitudes of industry over the past ten to fifteen years. Another sixteen percent feel that there has been fair improvement. Six of eight provincial spokespersons feel that the improvement in industry's attitude has been good. One provincial official feels that the improvement has been fair, and another described the change in attitude as poor. When recognising that there will practically always be some difference in perspective between those regulating and those being regulated on the level of cooperation between the two sides, the answers are quite revealing. It would seem that there is a general agreement that the attitude of industry towards the need to protect the environment has improved considerably over the years since the pollution abatement regulations were first established.

Table 3:9 records the value that provincial environmental spokespersons place on the existence of both the federal air emission guidelines and pulp and paper effluent regulations. All eight provincial agency spokespersons included in the survey indicate that the air emission

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[90] Chapter Two, pp.122-139.

TABLE 3:8

CHANGING ATTITUDE OF PULP AND PAPER INDUSTRY ABOUT THE NEED TO PROTECT THE ENVIRONMENT OVER THE LAST TEN TO FIFTEEN YEARS ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES AND PROVINCIAL AGENCY OFFICIALS[1] - 1987

	Changing Attitude of Industry About The Need for Environmental Protection			
	Industry and Mill Representatives		Provincial Agency Officials	
	#	%	#	%
Excellent	2	4.1	0	0
Very Good	12	24.5	0	0
Good	26	53.1	6	75.0
Fair	8	16.3	1	12.5
Poor	0	0	1	12.5
No Opinion	1	2.0	0	0
	49	100.0	8	100.0

[1] Saskatchewan provincial environmental agency officials did not comment.

Source: Industry and Provincial Agency Survey, 1987.

TABLE 3:9

PROVINCIAL AGENCY OFFICIALS[1] VIEWS AS TO THE VALUE OF FEDERAL AIR EMISSION GUIDELINES AND EFFLUENT ABATEMENT REGULATIONS AND THE NEED FOR THE CONTINUED USE OF FEDERAL GUIDELINES AND REGULATIONS - 1987

	Air Emission Guidelines		Effluent Abatement Regulations	
	#	%	#	%
Not Valuable	5	62.5	0	0
Very Valuable	0	0	3	37.5
Valuable	2	25.0	3	37.5
Valuable In The Past But of Limited Value at Present	1	12.5	2	25.0
Valuable In The Past But of No Value at Present	0	0	0	0
TOTAL	8	100.0	8	100.0
Should Be Continued	4	50.0	2	25.0
Should Be Continued But Updated	0	0	4	50.0
Should Be Continued But Should Be Changes In The Way They Are Applied	1	12.5	2	25.0
Should Be Discontinued	1	12.5	0	0
Indifferent As To Whether Continued Or Not	2	25.0	0	0
TOTAL	8	100.0	8	100.0

[1] Saskatchewan provincial environmental agency officials did not comment.

Source: Industry and Provincial Agency Survey, 1987.

guidelines and effluent regulations were valuable in the past. All feel that the effluent regulations should be continued. Four feel that they should be updated, and two indicate a need to change the way they are applied. The spokespersons for one environmental agency feels that the air emission guidelines should be updated; one feels that they should be discontinued. Unlike the air emission guidelines, where spokespersons for two provincial agencies were indifferent to whether or not the guidelines continue to exist, all provincial spokespersons feel that the federal effluent regulations should be continued. Six indicate the need for some changes in either the way the regulations are administered or the regulations themselves.

The information presented in Tables 3:2 through 3:9, clearly shows the appropriateness of the administrative process that originally was established by EP and the DOE. Even though the numbers included in the provincial breakdowns appear small, they do in fact overwhelmingly represent the views of those provincial environmental personnel responsible for regulating the pulp and paper industry in Canada. Therefore, on the basis of the foregoing, and in terms of establishing arrangements which encourage the cooperation of the provinces and industry, the regulations have to be considered a success.

Even though the regulations have resulted in the development of appropriate delivery mechanisms, there has only been very limited success in bringing the total of the industry under federal effluent regulations. This is partially due to the passage of time, and it is partially due to the legal limitations which are implicit in the approach adopted. The expanded and altered mill categories, which were established to bring existing mills gradually under the regulations as growth takes place in the industry, are at best questionable in law. Although many of the mills which are considered expanded for the purpose of the regulations have increased production in excess of ten percent, these output increases usually take place over a period of time. The courts appear reluctant to accept mills as expanded, until it can be proven that certain specific mill modifications resulted in an increase of more than ten percent at a particular point in time.[91] They appear reluctant to interpret the reason for mill modifications. With no clearly established understanding of what output increases actually took place, or the reason for mill alterations, it is very difficult to prove that a mill is either altered or expanded. As it currently stands, the obligation for industry to comply with the regulations appears to have been substantially reduced, because of the uncertainty about what provisions in the regulations can be enforced in law.

The use of compliance agreements suffers from similar difficulties. The negotiation of compliance agreements, which were intended to establish deadlines for mills to meet discharge standards at a specific point in time,[92] have been determined to have no force in law unless registered.[93] However, whether registered or not, once a compliance schedule is negotiated, any attempt by the government to impose compliance through the courts usually results in a decision favouring mill operators, because of difficulties in interpretation under the law.[94] When mill operators are unable to comply with the conditions outlined in a compliance schedule, EP personnel have no choice but to renegotiate. The result is that unproclaimed compliance schedules have detracted from the ability of those responsible for administering the regulations to enforce standards.

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[91] Additionally there appears to be an element of confusion about the definitions themselves. See: Her Majesty the Queen vs E.B. Eddy Forest Products Limited, before His Honour Judge W.M. Fitzgerald, Esponola, Ontario, February 3 1988.

[92] Recorded in Hansard of House of Commons, January 27 1971.

[93] Webb, op. cit., Chapter 5(R)P:(ONE), p.92.

Uncertainty about the regulations with respect to the law also detracts from some of the desirable aspects of the systematic approach envisioned when the regulations were being developed. Those responsible for drafting the regulations recognised that industry-wide waste discharge reductions could not be satisfactorily achieved over the long-term unless the regulations were subject to continuous review as new technological advances took place and new information became available.[95] The use of such review procedures would have helped ensure that the federal standards continue to be consistent with the best practicable technology available through time. Such reviews also would have provided those who are responsible for negotiating compliance schedules with up-to-date information on what could be realistically expected of industry. While EP has attempted to undertake a regulative review on a number of occasions, none have been completed. This can be partially explained by the difficulties encountered when trying to reach consensus with industry and each of the provinces on what changes are necessary. It also can be explained in terms of the fact that the majority of mills in Canada do not come under regulations, and many of the mills which are thought to be altered or expanded may not be found subject to the regulations by the courts. As a consequence, it would seem that there is little reason to proceed with the very difficult and time consuming consultative process with industry and the provinces to revise standards, if legal uncertainties bring into question the ability of federal authorities to require industry to meet standards.

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[94] Webb, op. cit., Chapter 5(R)P:(ONE), pp.93-99. The Queen vs E.B. Eddy, op. cit., p.42.

[95] Minutes of Proceedings and Evidence of Standing Committee on Fisheries and Forestry, April 30 1970, p.19:9, April 27 1971, p.7:14, Keyes and Jackson, op. cit., Ottawa, January 1972, p.34.

The very substantial achievements that were made in establishing a structure for controlling pulp and paper waste discharges during the years following the introduction the effluent regulations have not been matched by demonstrable progress in recent years. In fact, it could be argued that the regulations, which were appropriate to the circumstances of the 1970's, have become unenforceable and outdated with the passage of time. The arrangements that were made with the provinces and industry to engender cooperation, also somewhat paradoxically, have made it very difficult to update the regulations. The failure to update the regulations, in turn, has resulted in legal interpretations, that appear to inhibit the ability of federal authorities to gradually bring the total of the industry under the regulations over time. This suggests that a reexamination of the regulations and the powers obligating compliance should be undertaken.

Despite these legal complications, it should be recognised the federal approach to regulating the pulp and paper industry has to a very large extent been an administrative success. The regulations provide for a systematic approach for reducing pollution, and also allow for the protection of those being regulated. The role of EP is first and foremost to protect the environment in the interest of all Canadians. There practically always is disagreement over the most publicly desirable way to reduce pollution. Nonetheless, the Fisheries Act absolutely prohibits the discharge of deleterious substance in the water. Consequently, virtually every pulp and paper mill in Canada could be prosecuted under the strength of the Fisheries Act. The regulations not only clarify what is required of a mill at any given point in time, but allow for the proclaimed authorisation of discharges in return for a genuine effort on the part of mill operators to reduce pollution. The federal regulations have resulted in reducing the number of agencies that industry has to deal with on environmental issues. As such they have protected the integrity of industry by helping to provide mill managers with the stable climate in which they can operate.

The regulations also are advantageous to the provinces. The regulations provide provincial authorities with the freedom necessary to adopt more stringent standards as appropriate. They help ensure the right of each province to share equally in the opportunity to acquire new industry and provide employment by helping to maintain consistent environmental standards across the nation. The existence of the regulations allows for a balanced approach that takes into account the interests of all Canadian resource users. The regulations help reduce the single minded approach to environmental protection, that is often attributed to the Federal Government because of its strong fisheries responsibilities. In short, the regulations allow for an administrative approach that encourages economic growth and the creation of jobs. At the same time, they ensure the continued reduction of pollution over time. It is this type of process which emanates from the regulations, that ultimately allows Canadians to enjoy sustained economic prosperity as well as a clean healthy environment through time.[96]

Summary

Even though the Federal Government has been involved in controlling industrial waste discharges since the turn of the century, it was not until the Parliament of Canada passed the Government Organizations Act in 1970, that the focal point for such activities was established within the new Department of the Environment. The specific responsibilities of the new Department of the Environment, as outlined in the Act is to protect and enhance the natural environment including water, air, and soil quality. The principle legal mechanisms initially were the Fisheries Act, and the Canada Water Act of 1970. Later the Ocean Dumping and Control Act of 1975, the Environmental Contaminants Act of 1976, and the Clean Air Act of 1979 were established to augment the delivery capability of the Department. The Canadian Environmental Protection Act of 1988 further strengthens the ability of the Department to address a broader range of pollution issues in future. Nonetheless, it is the nearly 100 year old Fisheries Act, which is currently used by the Federal Government as the principal authority for controlling industrial wastes in Canada.

The specific authority for controlling industrial wastes was established in 1970, when the Fisheries Act was amended to allow for the formulation of industrial pollution control regulations. As revealed at the time the amendments to the Fisheries Act were brought before parliament and the Standing Committee on Fisheries and Forestry, the intention was to establish a framework for reducing industrial pollution over time. The new regulations were not meant as "cure-alls" to solve all of Canada's industrial pollution problems. The regulations were to be enabling in the sense they would allow the Department of the Environment to work with provinces and the industry to reduce pollution. They were to be used to eliminate the possibility of pollution havens. They were to be technology based, and subject to regular review and adjusted to changing circumstances. The new regulations were to be administered in a way, which would take into account the financial burden on individual firms, the economic circumstances of the community or region where the production facilities were located, and the impact on the public. A major objective, as stated at the time, was to clarify a leadership role in industrial pollution abatement which was appropriate to the federal constitutional responsibilities.

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[96] The Honourable Jack Davis, op. cit., p.2826.

At the time the amendments to the Fisheries Act were being discussed in parliament, it was estimated that the pulp and paper industry accounted for close to half of the industrial waste dumped into Canadian waters. Understandably, the pulp and paper industry was singled out as the first industry to be brought under the new regulatory process. A task force which included provincial officials and representatives of industry was set-up to develop pulp and paper effluent regulations. The task force was given certain basic principles that were to be adhered to when formulating the regulations. Consistent with the various presentations before Parliament and Parliamentary Committee, the standards were to be minimum requirements which would be applied on a nation-wide basis using existing technology. Emphasis was to be put on controls, which could be applied within the "factory fence" to allow for variations in production processes and locational differences. New mills were to come under the regulations immediately, but existing mills were to be given time to adjust and brought under the regulations gradually over time. The regulations themselves were to compliment the efforts and regulative devices used by the provinces.

The recommendations that were put forth by the task force represented a negotiated compromise among the provincial, industry and federal representatives on the committee. The work of the task force resulted in the establishment of a set of standards in the form of numerical values that would become targets for old mills already in existence, enforceable limits for new mills that were built after 1971, and negotiated requirements for altered or expanded mills. Consistent with the principles outlined in the task force terms of reference, no time limit was set for existing (old mills) to be brought under the regulations. Old mills were to be brought under the regulations gradually through the use of negotiated compliance schedules, that would take into account the technical feasibility of the safeguards required, the financial burden on the company or mill, and the economic circumstances of the communities where the mills are located.

The same general principles that were used to establish the effluent abatement regulations were later used to develop air emission guidelines for the pulp and paper industry. The choice of guidelines rather than regulations, reflects the different recognised responsibility of the federal and provincial governments with respect to air and water. The intention of the pulp and paper air emission guidelines is to prevent the deterioration of ambient air quality in support of provincial initiatives to protect air quality. Once again they are minimum standards, that are meant to be applied uniformly across the country to avoid pollution havens. The air emission guidelines together with the effluent abatement regulations provide federal environmental officials with the tools necessary to work with provincial authorities to protect the environment from the total of the waste generated by pulp and paper manufacturers in Canada.

The efforts of Environmental Protection in controlling waste discharges from pulp and paper mills are conducted through a number of different program initiatives undertaken at the regional level. These initiatives are in fact on-going mechanisms that together provide the coordination necessary to handle both the short and long-term problems inherent in industrial waste management control. The basic mechanisms that are employed include: (1) The monitoring and testing of discharges to measure the level of compliance within the industry. (2) The maintenance of a regional referral system between levels of government and among agencies. (3) The use of formal federal-provincial agreements that require regional authorities to exchange information and to consult as appropriate to ensure a coordinated approach. (4) An immediate response capacity, at the regional level, to deal on an around the clock basis with environmental emergencies. (5) Participation in financial assistance programs to encourage the use of cleaner processes within industry. As is the case with both the regulations and guidelines, the success of these mechanisms in reducing the amount of waste discharged from the pulp and paper industry, to a very large degree, depends on the good-will and cooperation of the provinces and industry.

The pulp and paper industry air emissions guidelines are in fact targets that are meant to assist the provinces in setting enforcement criteria. They provide a comprehensive overall framework for reducing pulp and paper industry pollution on a nation-wide basis which are generally accepted by industry and seldom result in controversy. There is question among some provincial officials about the need for the continued use of these guidelines. Nonetheless, they are used by some provincial agencies in conjunction with their own regulations to establish appropriate standards for mills located within their jurisdiction.

In contrast to the air emission guidelines, the effluent abatement regulations are not only problematic to those who are responsible for their administration, but also are the focus for a substantial amount of criticism from both the public and industry. On the one hand, the public usually criticises the government for not being tough enough on industry by enforcing the regulations in accordance with the law. On the other hand, the industry usually complains that the standards are overly stringent and that government officials are not sensitive to the economic circumstances of the industry and the costs that result from adopting cleaner processes. The review undertaken in preparing this report, indicates that those requirements specifically established to ensure fairness in application, also serve as major reasons for most of the criticisms directed at EP personnel because of their administration of the regulations.

In this regard it was noted, that the regulations were set-up as minimum technical standards, which are to be applied uniformly across the country without distinction to mill type, process or location. However, they also are to be applied in a manner which takes into account the technology available and the financial circumstances of individual mills. Not all processes are equally adaptable to the introduction of pollution control technologies. Some locations are more environmentally sensitive than others. Certain processes are more widely used in some regions than others. Under such circumstances, those enforcing the standards have no choice but to balance the capacity of a mill to adopt cleaner production processes against the amount of risk imposed as the result of waste discharge. Therefore, even though the regulations do not explicitly take into account assimilative capacity, as a matter of practical necessity, the weighing of environmental risk against the capacity of a mill to adopt cleaner processes requires an implicit regard for the waste absorption capacity of the receiving environment, as well as the best technology that might be applied. This does not mean that pollution has to be tolerated, or that the laws will not be enforced. What it does mean is that in the vast majority of the cases, the complexities of the circumstances do not lend to the clear-cut interpretation of whether the terms and conditions of the regulatory requirements are being violated. Realistic trade-offs do not necessarily serve as evidence of bad faith or insincerity on the part of government officials, the use of trade-offs merely points to difficulties that are involved when trying to apply regulations in a manner which takes into account the concerns of all those affected by government environmental regulations.

Despite the many criticisms, when examined in terms of their original purpose, both the pulp and paper effluent regulations and air emission guidelines have to be considered an administrative success. As a result of the regulations and guidelines, Environmental Protection has successfully established a framework, which both the provinces and industry generally accept as appropriate for dealing with pollution within the industry. The patchwork approach that had previously resulted in inconsistent, and sometimes contradictory, advice to industry has been largely eliminated. Uncertainty about the respective jurisdictional responsibilities of the provincial and federal environmental authorities has been alleviated. Therefore even though the use of the Fisheries Act does detract somewhat from the even-handed nation-wide, industry-wide approach that was originally intended among the regions, it also consolidates the enforcement of pollution control within the pulp and paper industry under one administrative framework. The use of any other instrument to regulate the industry, might result in breaking down some of the coordination and cooperation which have been developed with such difficulty over the past seventeen years. The use of the Act also helps to ensure that all agencies involved will thoroughly review the circumstances surrounding each individual hazardous discharge, while taking into consideration the concerns of all other agencies in the region. This provides some minimal guarantee to Canadians, that each agency will act with appropriate dispatch, knowing that their efforts are of concern to others responsible for dealing with the consequences of industrial pollution.

The very substantial achievements that have been made in establishing a structure for controlling pulp and paper waste discharges during the years following the introduction of the effluent regulations have not been matched by demonstrable progress in recent years. This is partially due to the passage of time, and it is partially due to the legal limitations which are implicit in the approach adopted. The altered and expanded mill categories, which were established to bring existing mills gradually under the regulations as growth takes place in the industry appear questionable in law. Although many of the mills which are considered altered or expanded for the purpose of the regulations have increased production well in excess of ten percent, these output increases usually take place over an extended period of time. Practically all mill modifications increase production efficiency, and can lead to waste discharge reductions. Therefore, it is very difficult to prove that alterations are not made for mainly environmental reasons. With no clear date on when production increases actually take place, or the reason for mill alterations, it is very difficult to prove that a mill is either altered or expanded. As it currently stands, the obligation for industry to comply with the regulations appears to have been substantially reduced because of uncertainty about what provisions in the regulations can be enforced in law.

The negotiation of compliance schedules, which are intended to establish deadlines for mills to meet discharge standards at a specific point in time, have been determined to have no force in law unless registered. However, whether registered or not, once a compliance schedule is negotiated, any attempt by government to impose compliance through the courts usually results in a decision favouring mill operators, because of difficulties in legal interpretation. When mill operators are unable to comply with the conditions outlined in a compliance schedule, EP personnel have no choice but to renegotiate. The result is that the use of unproclaimed compliance schedules have detracted from the ability of those responsible for administering the regulations to enforce standards.

Those responsible for drafting the regulations recognised that industry-wide waste discharge reductions could not be satisfactorily achieved over the long-term unless the regulations were subject to continuous review as new technical advances took place and new information became available. Althougn EP has attempted to undertake a standards review on a number of occasions, none have been completed. This can be partially explained by the difficulties encountered when trying to reach a consensus with industry and each of the provinces on what changes are necessary. It also can be partially explained in terms of the fact that the majority of mills in Canada do not come under the regulations, and many mills which are thought to be altered or expanded may not be found subject to the regulations by the courts. As a consequence, it would seem that there is little reason to proceed with the very difficult and time consuming consultative process with industry and the provinces to revise standards, if legal uncertainties bring into question the ability of federal authorities to require industry to meet standards.

Despite the many legal and administrative complications, the federal national approach to regulating the pulp and paper industry has been successful. The regulations provide for a systematic approach for reducing pollution, and also allow for the protection of those being regulated. The regulations provide provincial authorities with the freedom necessary to adopt more stringent standards as appropriate. They help to ensure the right of each province to share equally in the opportunity to acquire new industry and provide employment by helping to maintain consistent environmental standards across the nation. They allow for a balanced approach that takes into account the interests of all Canadian resource users. However, the continued use of the regulations in their present form may not be appropriate for the future. The main difficulty is that existing mills, which constitute the majority of operating mills in Canada, have never been brought under the regulations. Until the regulations are proclaimed in force for existing mills, the standards specified in the regulations represent little more than guidelines for most mills, which cannot be enforced under the law. Existing mills, which because of high investment costs and what amounted to an "after the fact" legislated change in the rules in 1971, are not subject to the regulations. The logic of this approach is irrefutable in terms of the obvious need to protect a well established, long-standing, and valuable industry from the potential damages that could result from abrupt changes in legislative requirements. However, the wisdom of the continued use of this approach after sixteen years, in light of the enforcement complexities, the legal limitations, and knowing when all mills should be required to meet the standards is not so clear. This suggests that an reexamination of the authority of the department under the regulations, the standards, and the powers obligating industry to comply is probably in order.

CHAPTER FOUR

THE CONTRIBUTION OF FEDERAL ENVIRONMENTAL EFFORTS IN REDUCING PULP AND PAPER INDUSTRY POLLUTION

The purpose of this Chapter is to assess the achievements attributable to federal pollution control efforts in the pulp and paper industry over the years 1971 to 1985. These efforts will be examined in terms of the original goals established during the period leading up to the adoption of the effluent abatement regulations in 1971. National and regional effluent waste discharge and air emissions information are presented. Regional variations in environmental performance are explored. Estimates on the ongoing administrative costs to industry and government are provided. The contribution of government is examined in terms of the accomplishments of industry in reducing waste discharges. A necessarily subjective assessment of the contribution of Environmental Protection in influencing waste reductions is undertaken. The continued participation of the Federal Government in regulating pollution standards for the pulp and paper industry is assessed on the basis of recognised government responsibilities, and the importance of industrial pollution as an issue of national public concern in each region.

Nation-wide Effluent Discharge and Air Emissions

Any examination of federal pollution abatement efforts in the pulp and paper industry necessarily requires some assessment of the progress made during the years since the first nation-wide regulations were adopted. The first and most obvious measurement of this progress is in the effluent and air emissions reductions that have been achieved within the industry over time. Such an examination also requires some indication of the environmental performance of the industry as it relates to federal compliance standards. It further requires some understanding of the ongoing efforts of industry in reducing the threat to the environment from their manufacturing operations. Relevant information on these matters are presented in what follows.

The estimated average total daily effluent reductions achieved for TSS, BOD, and acute toxicity by the pulp and paper industry over the period beginning in January 1970 to the end of 1985 are presented in Figure 4:1. Estimates on the average level of discharge for nation-wide compliance with the effluent abatement regulations are included for this same sixteen year period shown in the Figure. The average daily total final production of the industry is also provided for the same period of time. According to the information contained in Figure 4:1, the total average daily production of that portion of the industry discharging effluent directly into Canada's waterways has risen from approximately 53,000 tonnes in 1970 to almost 69,000 tonnes in 1985. During this same period, the total TSS loadings have decreased from an average of 2,100 tonnes per day in 1970 to just over 800 tonnes per day in 1985. BOD loadings have been reduced from an average of approximately 3,400 tonnes per day in 1970 to about 2,000 tonnes per day in 1985. Acute toxicity loadings[1] have been lowered from a daily average of about 8,800 thou-

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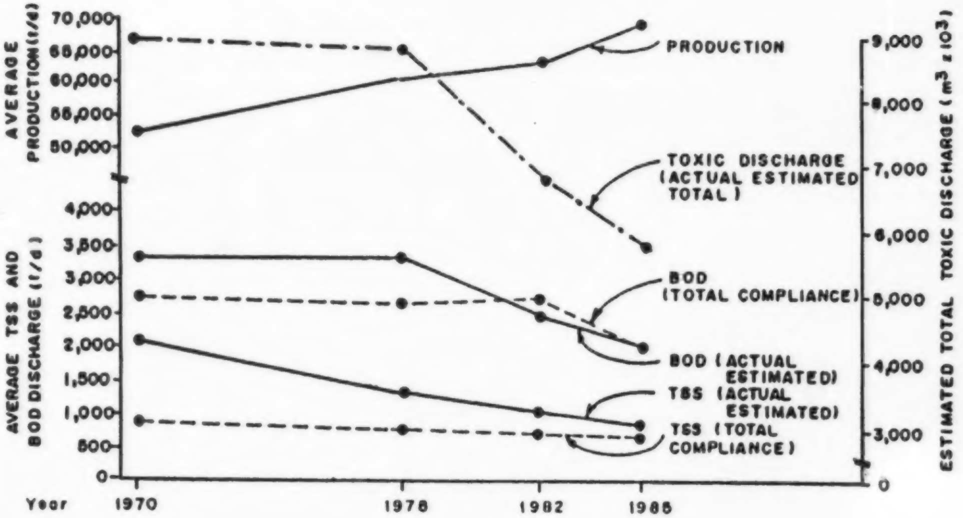
[1] The acute toxicity discharge information presented throughout this report is based on total flow as explained in Appendix I. The federal test for toxicity are pass/fail tests, which do not take into account the varying disruptive quality of the waste effluent discharged by different mills in different locations. Therefore, the (Continued on page 247)

FIGURE 4:1

ESTIMATED AVERAGE DAILY TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), IN TONNES (METRIC) AND TOXICITY[1] (TO FISH) (m^3x10^3) LOADINGS COMPARED WITH AVERAGE PRODUCTION OF FINISHED PRODUCT IN TONNES (METRIC) PER DAY BY DIRECT DISCHARGE MILLS[2] IN CANADA FOR THE YEARS 1970, 1978, 1982 AND 1985



1 Toxicity loadings are estimated on the basis of tests (often irregular) at mill sites, and are interpreted on the basis of average daily discharge and the proportion of "failed" tests to total tests conducted during the test year. For the purpose of this presentation, LC50 = 100 is considered equivalent to LC20 = 65.

2 Direct discharge mills are mills that discharge directly into the receiving environment and do not discharge through municipal sewage systems. There are 122 such mills in Canada which are monitored and regulated under federal regulations in cooperation with provincial environmental authorities.

Source: Environment Canada, Ottawa.

sand cubic meters in 1970 to 5,800 in 1985. The industry's effluent discharges, when taken in total, are approaching the daily average levels required to achieve nation-wide federal compliance for both TSS and BOD.

Figure 4:2 is used to present the estimated annual air emissions from the total of the pulp and paper industry for the period 1970 to 1986 inclusively (the 1980 to 1986 estimates are based on preliminary calculations which are currently being revised). According to the information presented in this Figure, the emissions of the common air contaminants from the industry have remained fairly stable over the years shown on the Figure. The very modest increases for some contaminants are generally offset by equally modest decreases for others. When viewed in light of the substantial production increases that have taken place within the industry over the period (approximately 31 percent), it can be seen that a reasonable amount of progress has been made in reducing the air contaminants released into the atmosphere over the seventeen years shown.[2]

The total reductions for TSS, BOD, and acute toxicity are presented for each of five regional areas in Figures 4:3, 4:4, and 4:5. The trends information presented in Figure 4:3 shows that there has been significant reductions in TSS discharges in all regions over the period 1970 to 1985. Quebec mills continue to have the highest TSS loadings, but the reductions achieved during the period 1982 to 1985 are quite substantial. In fact, the reduction achievements by Quebec mills during that

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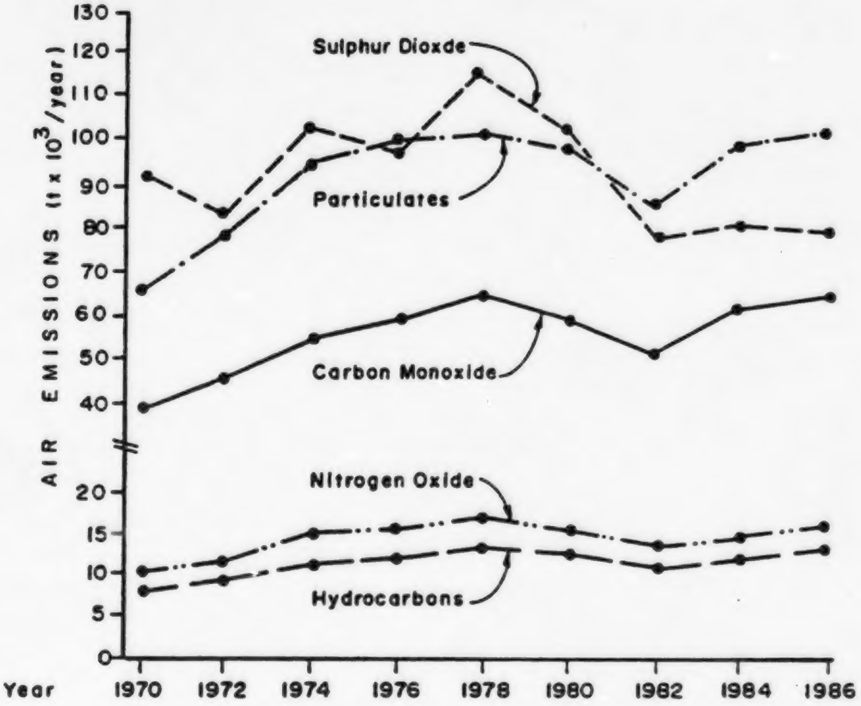
1 (Continued) calculations used in the report are considered appropriate for the comparative analysis which is presented. Such measurements should be interpreted with care for reasons which will become more apparent from the information and discussion presented in Chapter Five.

[2] The industry investment information, presented later in this Chapter, indicates that there has been a very large commitment by the industry to reduce air emissions in recent years.

FIGURE 4:2

ESTIMATED ANNUAL AIR EMISSIONS BY THE PULP AND PAPER INDUSTRY FOR COMMON AIR CONTAMINANTS:[1] 1970 - 1986

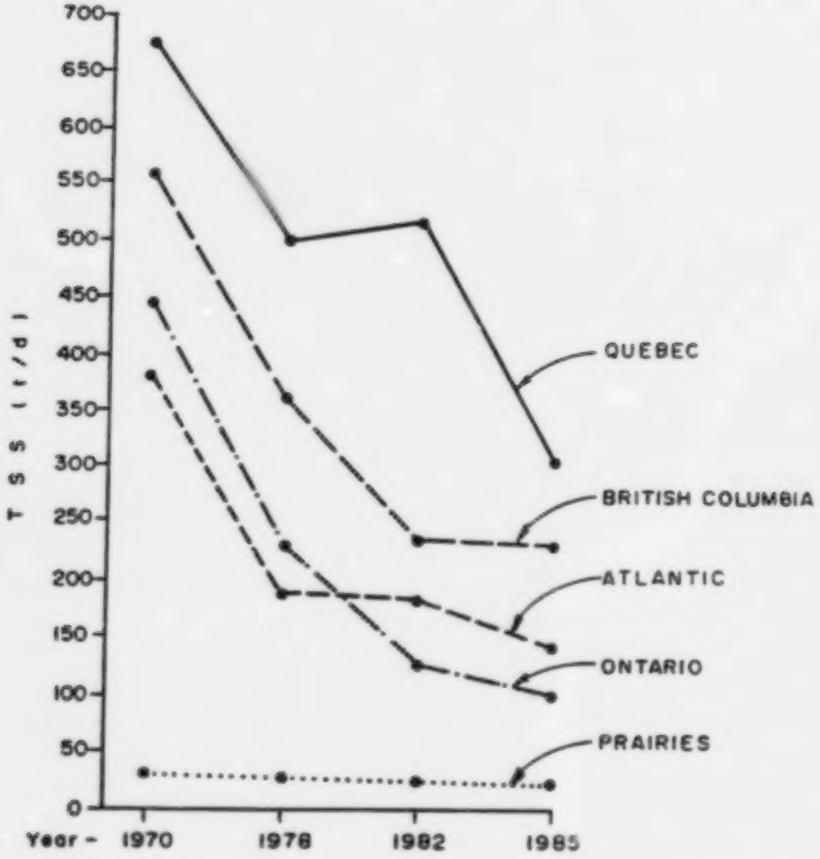


1 The air emission estimates are taken from Emission's Trend Report (noted below) up to and including 1980, then from information supplied by Ottawa Headquarters for years subsequent to 1980.

Source: Emissions and Trends of Common Air Contaminants in Canada: 1970 to 1986, Environment Canada, 1986 and Environment Canada, Ottawa, and information provided by Environmental Analysis Branch of Environmental Protection Ottawa.

FIGURE 4: 3

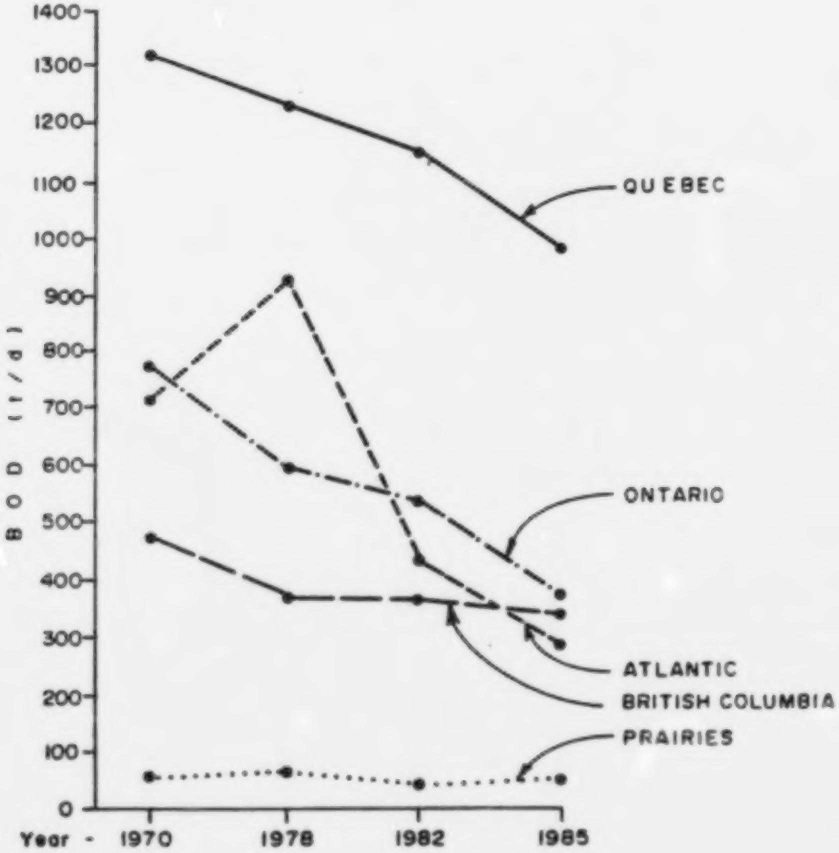
TOTAL SUSPENDED SOLIDS (TSS) DAILY DISCHARGE LOADINGS
BY DIRECT DISCHARGE MILLS ACCORDING TO REGION
1970 TO 1985



Source: Environment Canada, Ottawa.

FIGURE 4:4

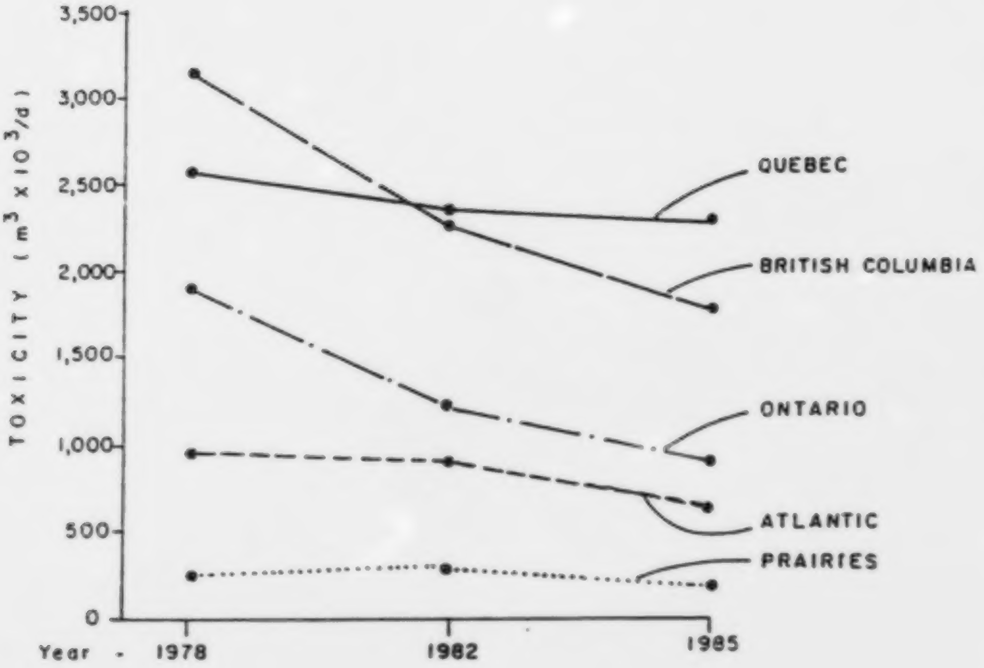
BIOCHEMICAL OXYGEN DEMAND (BOD) DAILY LOADINGS
BY DIRECT DISCHARGE MILLS ACCORDING TO REGION
1970 TO 1985



Source: Environment Canada, Ottawa.

FIGURE 4:5

ESTIMATED DAILY TOXIC (TO FISH) EFFLUENT LOADINGS[1] BY DIRECT DISCHARGE MILLS ACCORDING TO REGION 1978 TO 1985



[1] The accuracy of information contained in this graph depends on the volume of water passing through the individual mill and the number of tests taken during the time period most recent to the years reported on above. It is assumed that LC50 = 100 (i.e. 50 percent of fish die in 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours.

Source: Environment Canada, Ottawa.

four year period surpass the achievements by mills in all other regions.

Figure 4:4 shows the reductions for BOD according to region for the period 1970 to 1985. Mills in British Columbia achieved sharp declines in BOD loadings over the period 1978 to 1982. These reductions more than offset the BOD loadings increases that took place during the period 1970 to 1978. Quebec mills continue to have the highest BOD loadings, but once again, their total daily discharge declines have matched those of other regions for the period 1982 through 1985. Similar to mills in the Atlantic and Ontario, Quebec mills have achieved BOD loading reductions consistently over the entire period 1970 through 1985.

The acute toxicity discharge trends for each region are shown in Figure 4:5. The total toxic discharge flow from the pulp and paper industry has declined in every region over the period 1978 to 1985.[3] The greatest total decline in toxicity flow took place in British Columbia and Ontario. Nonetheless, British Columbia mills along with those in Quebec remain the highest acute toxicity loadings mills in Canada. All regions appear to have made some progress in reducing acute toxicity flow over the time period shown on the Figure.

Over the period 1970 to 1985, the total production of Canada's direct discharge mills increased by 31 percent (Figure 4:1).[4] Total effluent and air contaminants releases have declined or remained approximately the same over the same time period. The largest nation-wide declines were for TSS over the period 1970 to 1985. BOD loadings declined sharply over the period 1978 to 1985. Toxicity loadings declined most rapidly over the period 1978 to 1985. Common air contaminant emissions declined on a per tonne of production basis over the entire period 1970 to 1986. Mills located in all regions of Canada have contributed to reducing pollution within the industry.

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[3] Toxicity discharges for 1970 are not considered totally reliable, because of the very limited number of tests taken among mills in the industry during the early 1970's.

[4] See also Table 4:3 on p.262.

Industry Investment on Environmental Controls

A three year moving average of the estimated capital investment on controlling waste discharges into water by the pulp and paper industry for the year 1972 to 1984 is presented for each region in Figure 4:6.[5] According to the information contained in this Figure, the capital investment in water pollution abatement by the industry has been substantial for all mills in all regions during fifteen years recorded in the Figure. The investment by Quebec and Ontario mills was particularly high during the years immediately following the introduction of the modernisation program.[6] Although industry estimates are often depicted as being overly generous to industry,[7] this information shows that mills in all regions are making a contribution to reducing the environmentally disruptive waste material being dumped into Canadian waters.

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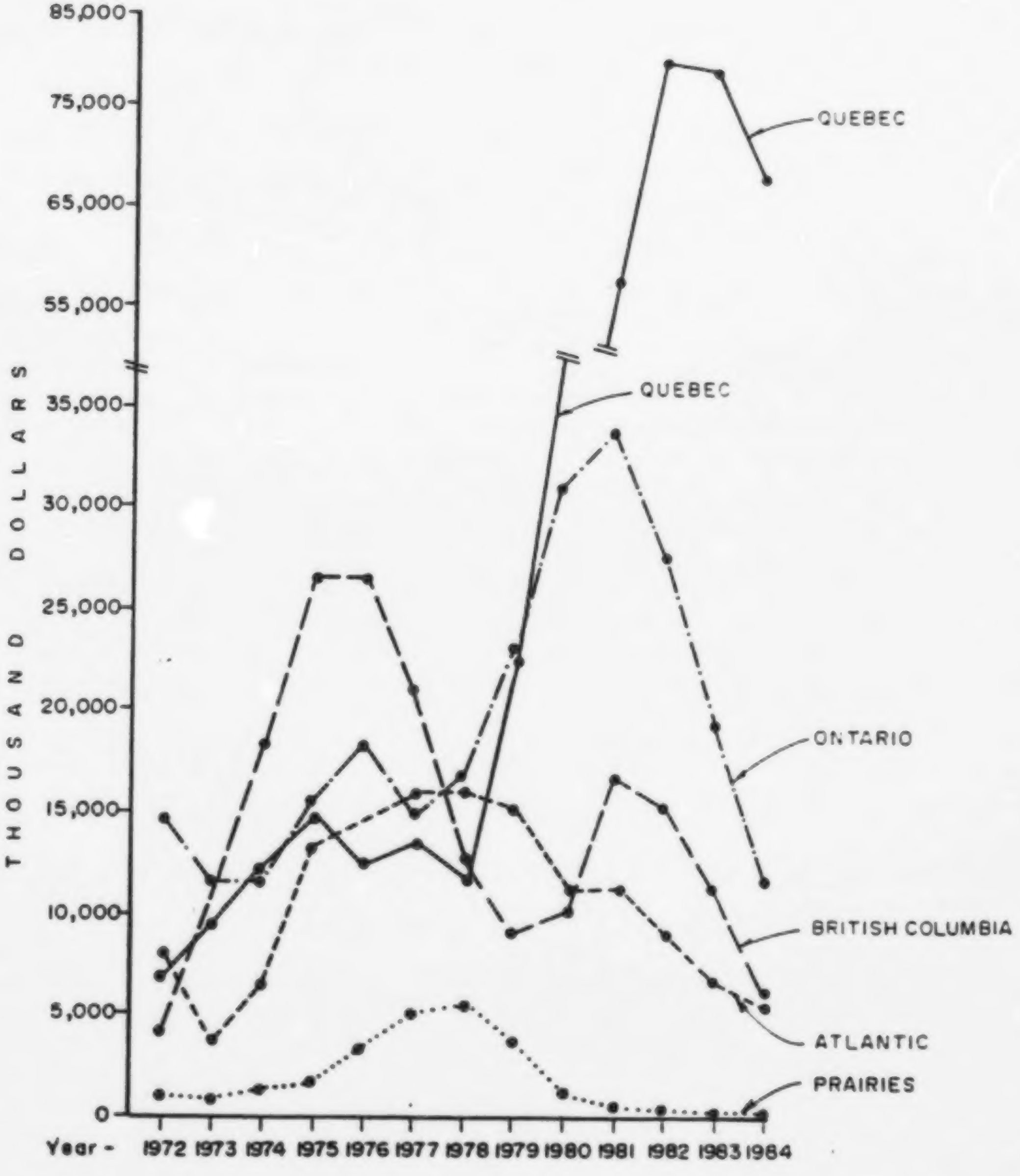
[5] Because the trend lines provided in the figures shown in this section are calculated by averaging industry investments over three or more years, one or more years at each end are not displayed on the Figure. Nonetheless, the reader should recognise that the investment estimates take into account all of the years beginning in 1971 through 1985. See Appendix I.

[6] The modernisation program (PPMP) was described in Chapter Three and will be discussed along with other financial assistance programs later in Chapter Six.

[7] Peter A. Victor, et al., Environmental Protection Regulation: Water Pollution, and the Pulp and Paper Industry, Technical Report Series, Technical Report No. 14, Economic Council of Canada, Ottawa, August 1981, p.38. See also: Appendix I.

FIGURE 4:6

THE CAPITAL INVESTMENT MADE BY THE PULP AND PAPER INDUSTRY TO CONTROL WASTE DISCHARGE INTO WATER (A 3 YEAR MOVING AVERAGE) ACCORDING TO REGION 1972 TO 1984



Source: Canadian Pulp and Paper Association of Canada

Figure 4:7 provides information on capital investment by industry on air contaminants emission controls by region for the period 1972 to 1984. Similar to the information provided above on water, mills in every region have made significant investments in controlling air emission discharges. Once again, Quebec and Ontario mills made the largest investment on air emissions controls during the years subsequent to 1980.

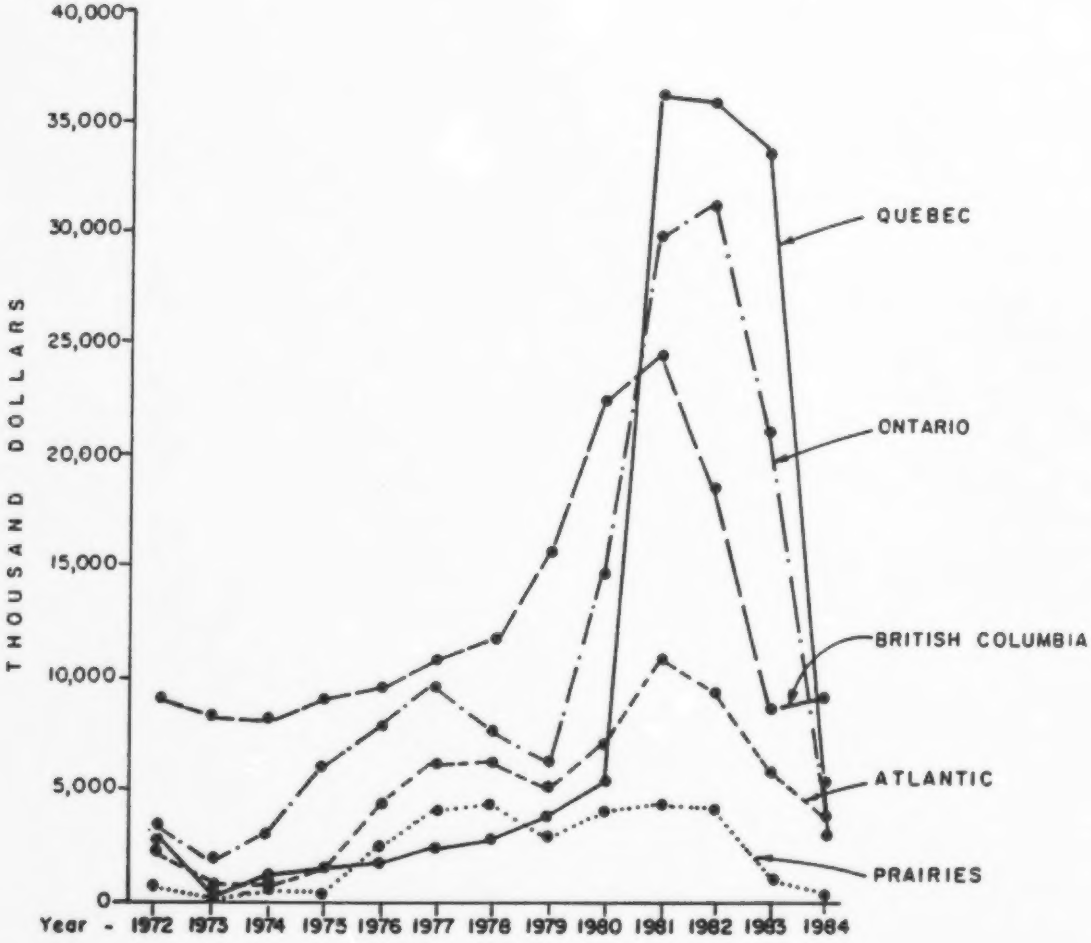
Figure 4:8 is used to compare industry's total capital investment on pollution controls with total capital investment within the industry over the years 1971 to 1985. These data indicate the average level of investment in pollution abatement represents between nineteen and seven percent of the total average capital investment within the industry over the period 1970 to 1985. The five year moving trend line provided in the Figure reveals a slow but steady decline in the average proportion of total capital investment devoted to controlling pollution over time.

Source of Effluent Discharges and Air Emissions

Tables 4:1 and 4:2 are used to show the source of total average daily effluent loadings (1985) and air emissions (1980) by region. The information contained in Table 4:1 indicates that Quebec mills have the largest average daily annual production, but they also have the largest average daily effluent loadings for all three loadings categories. Quebec mills account for over 48 percent of the BOD, nearly 40 percent of the acute toxicity, and well over one-third of the TSS dumped into Canada's waters by the pulp and paper industry each day. Quebec accounts for

FIGURE 4:7

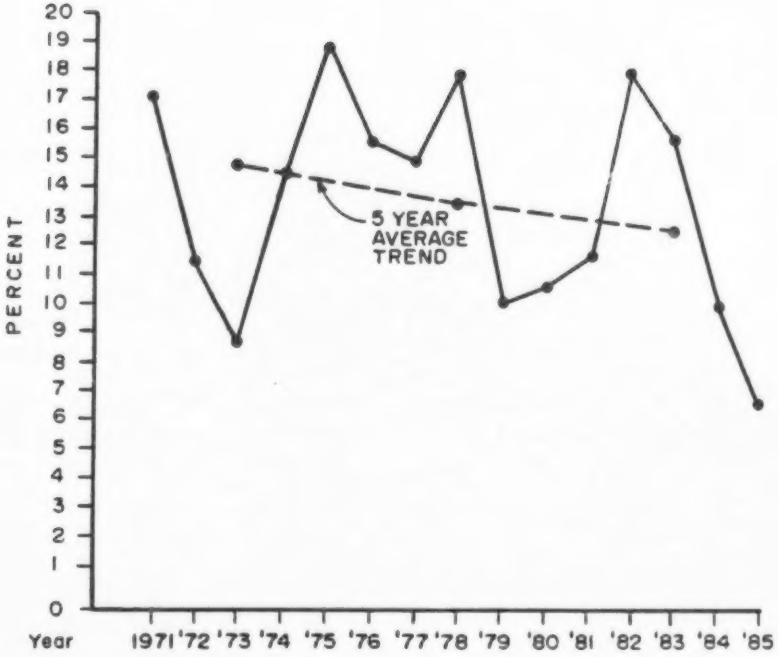
THE CAPITAL INVESTMENT MADE BY THE PULP AND PAPER INDUSTRY TO CONTROL AIR CONTAMINANTS (A 3 YEAR MOVING AVERAGE) ACCORDING TO REGION 1972 TO 1984



Source: Canadian Pulp and Paper Association of Canada

FIGURE 4:8

CAPITAL INVESTMENT[1] IN AIR AND WATER POLLUTION CONTROL AS A PERCENTAGE AND 5 YEAR AVERAGE OF TOTAL CAPITAL INVESTMENT IN THE PULP AND PAPER INDUSTRY
1971 TO 1985



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[1] 1985 total capital investment within industry is a preliminary estimate.

Source: Statistics Canada Expenditures Catalogue 6124 and information provided by Canadian Pulp and Paper Association of Canada.

TABLE 4:1

AVERAGE DAILY PRODUCTION COMPARED WITH AVERAGE DAILY SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND TOXICITY[1] (TO FISH) LOADINGS FOR PULP AND PAPER PRODUCING DIRECT DISCHARGE MILLS BY REGION - 1985

	Production (t/d)		TSS (t/d)		BOD (t/d)		Estimated Toxic Discharge ($m^3 x 10^3$)	
	#	%	#	%	#	%	#	%
British Columbia[2]	19,234	27.8	234	28.4	344	16.7	1,796	31.0
Prairies	2,851	4.1	29	3.6	53	2.6	196	3.4
Ontario	14,680	21.3	105	12.7	375	18.2	899	15.5
Quebec	22,354	32.3	311	37.7	989	48.1	2,291	39.5
Atlantic	10,020	14.5	145	17.6	295	14.4	619	10.7
Canada	69,139	100.0	824	100.0	2,056	100.0	5,801	100.0

[1] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[2] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has a LC50 = 80, another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa.

TABLE 4:2

AIR EMISSIONS BY THE PULP AND PAPER INDUSTRY OF COMMON AIR CONTAMINANTS[1] ACCORDING TO TYPE OF PULPING (KRAFT AND SULPHITE) - 1980

	Kraft (Sulphate) Mills (tonnes per year)										Sulphite[2] Mills (tonnes per year)			
	Particulate Matter		Sulphur Oxides		Nitrogen Oxides		Hydro Carbons		Carbon Monoxide		Particulate Matter		Sulphur Oxides	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
British Columbia	50,568	47.3	10,991	36.8	7,474	47.0	5,786	47.1	28,576	47.3	342	30.8	3,079	3.6
Prairies	6,132	5.7	8,237	27.6	1,254	7.9	979	8.0	4,793	7.9	0	0	1,933	2.3
Ontario	17,414	16.3	5,111	17.1	3,476	21.9	2,715	22.1	13,289	22.0	328	29.6	16,737	19.6
Quebec	19,816	18.5	3,389	11.4	2,191	13.8	1,709	13.9	8,058	13.4	0	0	29,750	34.8
Atlantic	12,975	12.1	2,109	7.1	1,500	9.4	1,109	9.0	5,644	9.4	440	39.6	33,987	39.8
TOTAL	106,905	100.0	29,837	100.0	15,895	100.0	12,298	100.0	60,360	100.0	1,110	100.0	85,486	100.0

[1] The air emission information presented in this table is process related and is not attributable to fuel combustion.

[2] Data are unavailable for particulate matter emissions in some regions. Data on regional emissions are not available in detail presented on this Table for years subsequent to 1980.

Source: Emissions and Trends of Common Air Contaminants In Canada: 1970 to 1980, Report EPS 7/AP/17, Environment Canada, Ottawa, September 1986.

somewhat less than one-third of the Canadian pulp and paper industry's average daily production. British Columbia mills, with the second highest daily production levels nation-wide, accounted for 28.4 percent of TSS loadings, 31 percent of toxicity loadings, and a respectable 16.7 percent of BOD loadings. The total loadings of mills in Quebec and British Columbia are more than proportional (except for B.C. in BOD), to their total contribution to production nation-wide. Mills in the Atlantic made greater than proportional (to production) contribution to nation-wide loadings for TSS. In other regional situations, the mill effluent discharges are less than proportional to their contribution to nation-wide production.

Table 4:2 contains information on the contribution of the mills located in each region to total annual common air contaminants caused by the pulp and paper industry in Canada for 1980. Although somewhat dated, this information indicates that the large kraft production mills in British Columbia are responsible for a very substantial percentage of the total kraft mills related air contaminants discharged into the atmosphere by the industry in Canada. Mills in British Columbia also accounted for 60 percent of the total air emissions control capital expenditures by the industry during 1985.[8] The air emissions data for sulphite mills are incomplete, and therefore it is not possible to comment further on the regional contribution to national total air emissions from these mills.

Although data gaps prevent a definitive analysis of the regional contribution to total air contaminants, the same is not true of the water related waste discharged. Table 4:3 is used to show the changes in average daily production for direct discharge mills in each region for the years 1970, 1978, and 1985. Table 4:4 is used to show the changes in production, TSS, and BOD loadings for each region over the period 1978 to 1985 inclusively. The information in Table 4:4 shows that the relative declines in TSS and BOD loadings vary quite considerably among regions over the total of the eight year period included in the Table. A comparison of the information contained in Tables 4:3 and 4:4 indicates that loadings declines do not appear to vary consistently with changes in final product output. Mills in the Atlantic provinces, with combined production increase of more than ten percent between 1978 and 1985, achieved the single largest loadings decrease for BOD (635 tonnes per day) among all mills in Canada. Ontario mills increased their production by seventeen percent and reduced TSS loadings by 55.7 percent. Ontario mills also did well for BOD. British Columbia mills did well for TSS, but performed somewhat less successfully for BOD. Although it should be noted, that the absolute level of BOD discharge by British Columbia mills is relatively low, when compared to mills in other regions for most of the years since 1978 (Figure 4:4). The relatively smaller reduction achievement of mills in British Columbia is more an indication of the good performance of mills in other regions of Canada, rather than an indication of poor performance among mills in British Columbia.

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[8] Based on information provided by the Canadian Pulp and Paper Association of Canada. The moving average information provided in Figure 4.7 disguises the relatively high investment made by British Columbia mills on air during 1985, because it is averaged with low investment years of 1984 and 1983.

The information on acute toxicity contained in Table 4:5 reveals similar regional variations. With a final production increase of seven-

TABLE 4:3

AVERAGE DAILY PRODUCTION OF DIRECT DISCHARGE MILLS IN CANADA ACCORDING TO REGION 1970, 1978, AND 1985

	1970 Average Daily Production t/d		1978 Average Daily Production t/d		1985 Average Daily Production t/d	
	#	%	#	%	#	%
British Columbia	13,107	24.9	16,072	25.9	19,234	27.8
Prairies	1,490	2.8	2,669	4.3	2,851	4.1
Ontario	11,741	22.3	12,809	20.6	14,680	21.3
Quebec	18,479	35.1	21,403	34.5	22,354	32.3
Atlantic	7,852	14.9	9,063	14.6	10,020	14.5
Canada	52,669	100.0	62,017	100.0	69,139	100.0

Source: Environment Canada, Ottawa.

TABLE 4:4

TOTAL SUSPENDED SOLIDS (TSS) AND BIOCHEMICAL OXYGEN DEMAND (BOD) DAILY LOADINGS BY DIRECT DISCHARGE PULP AND PAPER MILLS IN EACH REGION FOR THE YEARS 1978, 1982 AND 1985: A COMPARISON OF THE PERCENTAGE INCREASE (DECREASE) IN AVERAGE DAILY TSS, BOD AND PRODUCTION FOR THE YEARS 1978 TO 1985

	1978				1982				1985				% Increase (Decrease) Between 1978 - 1985		
	TSS (t/d)		BOD (t/d)		TSS (t/d)		BOD (t/d)		TSS (t/d)		BOD (t/d)				
	#	%	#	%	#	%	#	%	#	%	#	%	TSS	BOD	Production
British Columbia	367	27.4	372	11.6	243	21.9	365	14.5	234	28.4	344	16.7	(36.2)	(7.8)	19.7
Prairies	33	2.5	67	2.1	32	2.9	42	1.7	29	3.6	53	2.6	(12.1)	(20.9)	6.8
Ontario	237	17.7	606	18.9	130	11.7	536	21.3	105	12.7	375	18.2	(55.7)	(38.3)	17.0
Quebec	507	37.9	1,235	38.5	521	46.9	1,143	45.3	311	37.7	989	48.1	(38.7)	(20.0)	7.3
Atlantic	194	14.5	930	29.0	184	16.6	435	17.3	145	17.6	295	14.4	(25.3)	(68.4)	10.6
Canada	1,338	100.0	3,210	100.0	1,110	100.0	2,521	100.0	824	100.0	2,056	100.0	(38.4)	(35.9)	13.0

Source: Environment Canada, Ottawa.

TABLE 4:5

ESTIMATED DAILY TOXIC[1] (TO FISH) EFFLUENT LOADINGS BY DIRECT DISCHARGE PULP AND PAPER MILLS IN EACH REGION 1978 AND 1985: COMPARISON OF PERCENTAGE INCREASE (DECREASE) IN PRODUCTION AND ESTIMATED TOXIC DISCHARGE OVER EIGHT YEAR PERIOD 1978 TO 1985

	1978		1985		% Increase (Decrease) Between 1978 and 1985	
	Effluent Discharge Considered Toxic ($m^3 x 10^3/d$)	%	Effluent Discharge Considered Toxic ($m^3 x 10^3/d$)	%	Total Estimated Toxic Discharge	Production
British Columbia[2]	3,142	35.7	1,796	31.0	(42.8)	19.7
Prairies	227	2.6	196	3.4	(13.7)	6.8
Ontario	1,892	21.5	899	15.5	(52.6)	17.0
Quebec	2,579	29.3	2,291	39.5	(11.2)	7.3
Atlantic	969	11.0	619	10.7	(36.1)	10.6
Canada	8,809	100.0	5,801	100.0	(34.2)	13.0

[1] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[2] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement one has a LC50 = 80, another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa in cooperation with the provinces.

teen percent between 1978 and 1985, Ontario mills had the greatest reduction in acute toxicity loadings (52.6 percent). Ontario mills also reduced their contribution to total average daily acute toxicity loadings nation-wide from 21.5 percent in 1978 to 15.5 percent in 1985. British Columbia mills, which account for 31 percent of the industry's toxicity loadings, reduced their toxicity discharge by 42.8 percent. Atlantic mills also performed well in reducing toxicity loadings, but Quebec mills actually increased their total contribution to national acute toxicity loadings over the eight year period (by more than 10 percentage points). The Quebec share of average final daily production decreased from 34.5 percent in 1978 to 32.3 percent in 1985 (Table 4:3).

The rather substantial differences in environmental performance among mills located in different regions in Canada cannot be explained in terms of average daily production levels. Neither can these differences be explained on the basis of the types of products produced. Table 4:6 is used to show the TSS and BOD loadings according to final product for direct discharge mills in Canada during 1985. The data presented in this Table indicates that overall TSS and BOD loadings vary in proportion to the total level of production for all but one of the major production groups. Newsprint accounts for a proportionally greater amount of the total TSS and BOD loadings in Canada. This would be significant for Quebec, because mills in that province account for nearly one-half of all Canada's newsprint production (See: Table 2:7). However, when these same information are examined more closely, it also can be seen that British Columbia mills produced less than seventeen percent (Table 2:7) of

TABLE 4:6

AVERAGE DAILY PRODUCTION COMPARED WITH AVERAGE DAILY TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD) LOADINGS FOR DIRECT DISCHARGE MILLS IN CANADA BY MAIN PRODUCT - 1985

	Production t/d		Discharge t/d			
			TSS		BOD	
	#	%	#	%	#	%
Newsprint	27,646	40.0	360	43.7	1,032	50.2
Newsprint and Other[1]	1,076	1.6	11	1.3	14	.7
Market Pulp	21,856	31.6	286	34.7	545	26.5
Market Pulp Paper and Other Products[2]	10,571	15.3	112	13.6	255	12.4
Other Products[3]	7,990	11.6	55	6.7	210	10.2
TOTAL	69,139	100.0	824	100.0	2,056	100.0

1 "Newsprint and other" category includes newsprint as well as groundwood specialty products.

2 "Market pulp, paper and other products" includes market pulp and also fine papers, tissues, paper for conversion to paper bags and other similar product lines such as wrapping paper and printing paper.

3 "Other products" includes corrugating paper board, liners, construction materials.

Source: Environment Canada, Ottawa.

Canada's total newsprint production in 1985, but accounted for 28.4 percent (See: Table 4:1) of TSS discharge. Mills in Ontario produced 18.5 percent of the nation's newsprint in 1985, but the BOD and TSS loadings of these mills were considerably less than what could be anticipated as a result of the levels shown in Table 4:6. Unless some further explanation, which relates to product type can be used to explain why British Columbia and Ontario mills are exceptions to the norm, regional differences in the type of final product production cannot be used to explain the regional variances in environmental performance.

Table 4:7 is used to present information comparing the environmental performance of mills producing different types of products between 1978 and 1985. These data confirm that newsprint facilities account for a disproportionate amount of TSS and BOD discharge. However, the comparisons shown on the Table indicate that the average daily newsprint production increased by only 7.2 percent, while TSS and BOD reductions of 41.6 and 24.2 percent were achieved by newsprint mills during the eight year period. Mills producing newsprint and newsprint and other products were responsible for loadings reductions, which are either comparable to or in excess of any other product categories.

When the information provided in Table 4:8 is compared with the information contained in Tables 4:6 and 4:7, it becomes apparent that the absolute level of effluent loadings within the industry is influenced, to a very major extent, by the type of pulping processes used in manufacturing.[9] According to the information in Table 4:8, sulphite mills

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[9] The importance of the type of pulping processes used in manufacturing in determining the total effluent loadings was discussed earlier in Chapter Two.

TABLE 4:7

COMPARISON BETWEEN 1978 AND 1985 TOTAL AVERAGE DAILY TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND PERCENTAGE INCREASE (DECREASE) IN PRODUCTION AND LOADINGS FOR DIRECT DISCHARGE MILLS IN CANADA BY MAIN PRODUCT PRODUCED

	1978				1985				% Increase (Decrease) Between 1978 - 1985		
	Discharge t/d				Discharge t/d						
	TSS		BOD		TSS		BOD				
	#	%	#	%	#	%	#	%	Production	TSS	BOD
Newsprint	616	46.0	1,361	42.4	360	43.7	1,032	50.2	7.2	(41.6)	(24.2)
Newsprint and Other[1]	15	1.1	38	1.2	11	1.3	14	.7	77.3	(26.7)	(63.2)
Market Pulp	384	28.7	1,256	39.1	286	34.7	545	26.5	7.5	(25.5)	(56.6)
Market Pulp Paper and Other Products[2]	200	14.9	352	11.0	112	13.6	255	12.4	22.7	(44.0)	(27.6)
Other Products[3]	123	9.2	202	6.3	55	6.7	210	10.2	20.0	(55.3)	4.0
TOTAL	1,338	100.0	3,209	100.0	824	100.0	2,056	100.0	11.5	(38.4)	(35.9)

[1] "Newsprint and other" category includes newsprint as well as groundwood specialty products.

[2] "Market pulp, paper and other products" includes market pulp and also fine papers, tissues, paper for conversion to paper bags and other similar product lines such as wrapping paper and printing paper.

[3] "Other products" includes corrugating paper board, liners, and construction materials.

Source: Environment Canada, Ottawa.

TABLE 4:8

TOTAL DAILY PRODUCTION COMPARED WITH DAILY TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD)[1], AND TOXICITY[2] (TO FISH) LOADINGS BY MAJOR PROCESS - 1985

	Production t/d		TSS (t/d)		BOD (t/d)		Estimated Toxic Effluent Discharge ($m^3 x 10^3/d$)	
	#	%	#	%	#	%	#	%
Sulphite[3]	13,719	19.8	196	23.8	991	48.2	1,539	26.5
Sulphite/ New Processes	4,462	6.5	88	10.7	151	7.3	296	5.1
New Processes	11,999	17.4	148	18.0	282	13.7	1,187	20.5
Kraft (Sulphate)	32,661	47.2	348	42.3	532	25.9	2,639	45.5
Groundwood	1,335	1.9	13	1.6	12	.6	37	.6
Other Processes	4,963	7.2	30	3.7	88	4.3	103	1.8
TOTAL	69,139	100.0	823	100.0	2,056	100.0	5,801	100.0

[1] The TSS, BOD, and production for mills using both sulphite and kraft were apportioned on the basis of the production records for the individual mills in 1985 and 1978.

[2] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[3] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechancial pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

Source: Enviroment Canada, Ottawa.

accounted for disproportionately high share of the total TSS and BOD loadings in Canada during 1985. Sulphite mills and mills using new processes, either in combination with sulphite or alone, together accounted for more than one-half of all the acute toxicity loadings caused by the industry in Canada during that single year. The apparently higher proportional contribution of newsprint production probably can be most accurately explained by the large amount of sulphite (roughly twelve percent) and new processes (approximately 35 percent) pulp production which is used to produce newsprint.[10]

The significance of sulphite and new processes pulp production in determining the total effluent loadings caused by the industry is more clearly revealed by the information presented in Tables 4:9 and 4:10. The information in 4:9 shows that sulphite production declined by 37 percent over the period 1978 to 1985, and that TSS and BOD average daily loadings by sulphite mills have decreased by 64.7 and 54.1 percent respectively. As sulphite production has gone down, there has been a greater than proportional decline in both TSS and BOD loadings from sulphite mills. This is an indication that those sulphite mills with the highest loadings are converting to other pulping processes. As new process pulp production has risen, there has been a greater than proportional increase in BOD loadings. However, high fiber recovery in new processes has resulted in less than a proportional increase in TSS.

Table 4:10 is used to show the acute toxicity discharges and production level changes through 1978 and 1985 among pulp processing

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[10] As is shown later in Table 4:12, twenty of the 28 sulphite mills in Canada produced newsprint in 1985.

TABLE 4:9

COMPARISON BETWEEN 1978 AND 1985 TOTAL AVERAGE DAILY PRODUCTION, TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD) LOADINGS[1] AND PERCENTAGE INCREASE (DECREASE) FOR DIRECT DISCHARGE MILLS IN CANADA BY MAJOR PRODUCTION PROCESS[2]

	1978				1985				% Increase (Decrease) Between 1978 - 1985		
	Discharge t/d				Discharge t/d						
	TSS		BOD		TSS		BOD		Production	TSS	BOD
	#	%	#	%	#	%	#	%			
Sulphite	555	41.5	2,159	67.3	196	23.8	991	48.2	(37.1)	(64.7)	(54.1)
Sulphite/ New Processes	58	4.3	98	3.1	88	10.7	151	7.3	110.6	51.7	54.1
New Processes	64	4.8	51	1.6	148	18.0	282	13.7	323.5	131.3	452.9
Kraft (Sulphate)	534	39.9	743	23.2	348	42.3	532	25.9	16.5	(34.8)	(28.4)
Groundwood	45	3.4	61	1.9	13	1.6	12	.6	(46.9)	(71.1)	(80.3)
Other Processes	81	6.1	97	3.0	30	3.7	88	4.3	5.9	(63.0)	(9.3)
TOTAL	1,337	100.0	3,209	100.0	823	100.0	2,056	100.0	11.5	(38.4)	(35.9)

[1] The TSS, BOD, and production for mills using both sulphite and kraft were apportioned on the basis of the production records for the individual mills in 1985 and 1978.

[2] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

Source: Environment Canada, Ottawa.

TABLE 4:10

ESTIMATED DAILY TOXIC[1] (TO FISH) EFFLUENT LOADINGS BY DIRECT DISCHARGE PULP AND PAPER MILLS BY MAJOR PRODUCTION PROCESS[2] IN 1978 AND 1985: COMPARISON OF PERCENTAGE INCREASE (DECREASE) IN PRODUCTION AND ESTIMATED TOXIC DISCHARGE OVER THE EIGHT YEAR PERIOD OF 1978 TO 1985

	1978				1985				% Increase (Decrease) Between 1978 - 1985	
	Production		Estimated Toxic Effluent Discharge		Production		Estimated Toxic Effluent Discharge			
	t/d	%	(m^3x10^3/d)	%	t/d	%	(m^3x10^3/d)	%	Production	Toxic Discharge
Sulphite	21,817	35.2	3,306	37.5	13,719	19.8	1,539	26.5	(37.1)	(53.4)
Sulphite/New Processes	2,119	3.4	205	2.3	4,462	6.5	296	5.1	110.6	44.4
New Processes	2,833	4.6	259	2.9	11,999	17.4	1,187	20.5	323.5	358.3
Kraft (Sulphate)	28,045	45.2	4,611	52.3	32,661	47.2	2,639	45.5	16.5	(42.8)
Groundwood	2,515	4.1	230	2.6	1,335	1.9	37	0.6	(46.9)	(83.9)
Other Processes	4,688	7.6	274	3.1	4,963	7.2	103	1.8	5.9	(62.4)
TOTAL	62,017	100.0	8,809	100.0	69,139	100.0	5,801	100.0	11.5	(34.1)

[1] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours). If a mill had more than one test during the most recent test year, then the proportion of the tests that failed to total number of tests taken are used to determine volume of toxic discharge.

[2] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

Source: Environment Canada, Ottawa.

categories. The information in this Table, similar to the information contained in Table 4:9, shows that decreases in sulphite production have resulted in greater than proportional decreases in acute toxicity from sulphite mills. Increases in new process pulp production has led to a proportionally greater amount of acute toxicity effluent. The obviously better performance of mills using a combination of sulphite new processes production would most likely relate to the mill modifications, which often are undertaken when a new production line is introduced into a mill. It would seem that those mills, which have carried out alterations to put in new production facilities, also have either installed new effluent control equipment or otherwise improved their ability to control waste discharge.

As discussed in Chapter Two, the pollution problems caused by the pulp and paper industry result directly from the production methods used in manufacturing. Not only do sulphite mills contribute disproportionately to the effluent loadings caused by the pulp and paper industry in Canada, but the overall performance of these mills in reducing effluent discharges has been well below the norm within the industry. The total effluent loadings from kraft mills are less than proportional to the contribution of these mills to total nation-wide production for all three loadings categories (TSS, BOD, and acute toxicity). Kraft mills increased total production by more than sixteen percent over the period beginning in 1978 through 1985. During that same period, kraft mills reduced their total TSS discharge by 34.8 percent, BOD loadings by 28.4 percent, and acute toxicity by 42.8 percent. The rather obvious difference in performance between sulphite mills and other pulping processes used within the industry contributes to differences in overall regional performance.

Regional Environmental Performance and the Federal Regulatory Process

Despite the emphasis placed on equal nation-wide application of federal effluent discharge standards, mills in all regions have not been equally successful in reducing effluent loadings over the years. Quebec mills continue to be the highest loading mills for all federally regulated effluent categories. British Columbia mills are the second highest loading mills in two of the three effluent categories included under federal regulations. Yet British Columbia mill operators complain that federal regulations are not enforced as vigorously among "eastern" mills as they are for mills located in that province.[11] Interior British Columbia mills complain with equal conviction, that their mills are required to meet more rigid standards than British Columbia marine mills. Notwithstanding the fact that the federal regulations are minimum standards, which are not meant to displace the pollution control initiatives of the individual provinces, the issue for federal environmental officials is whether or not the federal pollution efforts are reducing the possibility of pollution havens. Regardless of the absolute size of the loading reductions achieved by mills in Canada, if the majority in Canada continually out perform mills in one or two regions over an extended period of time, pollution havens will result.

As discussed previously in Chapter Two, the first requirements for establishing an acceptable effluent control system in a chemical pulping process operation is the installation of a chemical recovery system.[12] The cost of installing such a system in a sulphite mill cannot be economically justified in terms of the value of the chemicals recovered. However, when the mill is small, and the production levels are low, the total cost of installing chemical recovery equipment in a sulphite mill can surpass the revenue generating capacity of the operation.

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[11] These observations on the views of British Columbia mill operators are based on statements to EP regional personnel in the ongoing performance of their duties. They are included in this report as a result of similar statements made during the survey of industry that was undertaken as part of this study (See: Appendix I).

The information provided in Table 4:11 shows the number of sulphite mills in Canada according to region for 1977. It also shows the average daily production of these mills in total tonnes per day. According to this information, Quebec had twenty of the 42 mills operating in Canada during 1977. The sulphite mills in Quebec also had the lowest average production of any of the mills shown on the Table (and almost certainly the lowest for any single group of mills in Canada). These mills (See: Table 2:8) most likely are the oldest continually operating mills in Canada. Thus, in most cases the space available for installing additional external treatments is often very limited. When it is recognised that the installation of a chemical recovery system seldom results in effluent reductions which will solve the total of the water effluent problems at a sulphite mill unless secondary treatment is added, the economic difficulties that these mills have in achieving major effluent discharge reductions becomes obvious. This does not mean that sulphite mills with small daily production levels cannot achieve acceptable standards of environmental performance. Practically all sulphite mills in the United States have installed liquor recovery systems, and built

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[12] Chapter Two, p.79 and p.112.

TABLE 4:11

AVERAGE DAILY PRODUCTION OF SULPHITE PULP IN MILLS[1]
1977

	Number of Sulphite Mills	Average Daily Total Sulphite Production (t/d)	Average Daily Sulphite Production per Mill (t/d)
Ontario	9	1,767	196
Quebec	20	3,653	183
Atlantic, Prairies and British Columbia	13	2,901	223
Total	42	8,321	198

[1] Neutral Sulphite Semichemical (NSSC) mills are not considered sulphite mills. Sulphonated Chemical Mechanical Pulp (SCMP) mills are not included in calculations.

Source: Environment Canada, Ottawa.

external treatment facilities with good results.[13] Nonetheless, the costs of adopting such safeguards have been a major obstacle for a significant portion of the total number of mills located in Quebec for most of the years since 1970.

The relationship between newsprint and total average daily loadings is further revealed by the information presented in Table 4:12. The number of sulphite mills in Canada for each of four years over the period 1970 to 1985 are given together with the type of products produced and the sulphite mill recovery systems in place. It can be seen that the number of sulphite mills in Canada has decreased from 45 in 1970 to 28 in 1985. The number of chemical recovery systems in sulphite mills has increased from two to eight. This information supports the observation made earlier about newsprint and effluent loadings. The majority of sulphite mills in Canada produce newsprint. The relatively high effluent loadings of newsprint mills appears to relate mainly to the fact that most sulphite mills also produce newsprint.

Table 4:13 is used to provide a comparison between the number of sulphite mills operating in 1977 and the number operating during 1985 by region. As shown in the Table, total sulphite production in Ontario decreased by 29.6 percent as a result of the closure of three sulphite operations over the period 1977 through 1985. During this same period, Quebec sulphite production declined by 14.8 percent, because of the

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[13] There are a large number of older, low production sulphite mills in the United States with both primary and secondary treatment systems. One example is a sulphite mill's location in Wisconsin, which was built in 1921. This mill produces 92 tons of pulp per day and has both a primary clarifier and an aerated stabilisation basin. Another is in Washington State where a 540 ton per day sulphite mill built in 1921, has both a primary clarifier and an aerated stabilisation basin. (See Appendix IV).

TABLE 4:12

SULPHITE MILLS IN CANADA ACCORDING TO NUMBER AND PERCENTAGE WITH CHEMICAL RECOVERY SYSTEMS FOR EACH YEAR 1970, 1978, 1982, AND 1985

	Sulphite Newsprint Mills			Sulphite Market Pulp Mills		
	Number of Mills	Number with Recovery	% with Recovery	Number of Mills	Number with Recovery	% with Recovery
1970	31	1	3.2	11	1	9.1
1978[3]	30	3	10.0	8	3	37.5
1982[3]	27	3	11.1	5	3	60.0
1985[3]	20	4	20.0	5	5[4]	100.0

	Neutral Sulphite[1] Semichemical Pulp			Sulphite Mills in Canada		
	Number of Mills	Number with Recovery	% with Recovery	Total[2] Mills	Number with Recovery	% with Recovery
1970	3	0	0	45	2	4.4
1978[3]	4	0	0	41	5	12.2
1982[3]	3	0	0	34	5	14.7
1985[3]	2	0	0	28	8	28.6

1 Neutral Sulphite Semichemical (NSSC) mills that use non-sulphur pulping processes are not considered sulphite mills. Sulphonated Chemical Mechanical Pulp (SCMP) mills are not included in calculation

2 Total mills column is not necessarily the sum of the newsprint; s. market pulp, and NSSC columns because at least one mill produces both newsprint and market pulp.

3 One mill is included in calculations twice as producing both newsprint and market sulphite pulp.

4 Includes one mill with partial recovery.

Source: Environment Canada, Ottawa, and Canadian Pulp and Paper Association.

TABLE 4:13

A COMPARISON BETWEEN 1977 AND 1985 ON THE NUMBER OF SULPHITE[1] MILLS AND THEIR PRODUCTION ACCORDING TO REGION

	1977		1985		Number and Percentage Change 1977 to 1985	
	Number of Mills	Estimated Sulphite Production t/d	Number of Mills	Estimated Sulphite Production t/d	Number of Mills	% Sulphite Production t/d
Ontario	9	1,767	6	1,251	- 3	- 29.6
Quebec	20	3,653	13	3,113	- 7	- 14.8
Atlantic, B.C., Prairies	13	2,901	9	2,874	- 4	- 1.0
Total	42	8,321	28	7,238	-14	- 13.0

[1] Neutral Sulphite Semichemical (NSSC) mills that use non-sulphur pulping processes are not considered sulphite mills. Sulphinated Chemical Mechanical Pulp (SCMP) mills are not included in calculations.

Source: Environment Canada, Ottawa and Canadian Pulp and Paper Association.

operational displacement of sulphite production lines within the province. In all, it can be seen that there were fourteen less sulphite mills in 1985 than there were in 1977. On the basis of the information provided earlier on the loadings caused by sulphite mills, it may be that a substantial portion of the effluent discharge declines by mills in Quebec (and a more modest portion of loadings declines experienced in Ontario) are the result of decreased sulphite pulp production over the period 1977 to 1985.[14]

The comparatively large number of sulphite mills in Quebec helps to explain the waste control problems of mills in that province.[15] The number of operating sulphite mills also helps to explain the disproportionate loadings among newsprint mills nation-wide, and perhaps serves as an explanation for the rather substantial effluent discharge reductions that have been achieved by mills in that province in more recent years. More difficult to understand is the situation among mills located in British Columbia. These mills continue to be second in terms of average daily production, but they also have the second highest loadings for TSS and toxicity in Canada. The BOD loadings are relatively small in British Columbia, when compared to other regions. British Columbia mills, with mainly kraft pulp production, have matched but not out performed kraft facilities in other parts of Canada. Despite this, there is a considerable amount of controversy among industry representatives about government enforcement efforts, and the need to adopt the necessary environmental controls.

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[14] Sulphite mill production accounted for approximately 23 percent of mill production in the province of Quebec during 1977. Sulphite mill production was about fifteen percent of Ontario mill pulp and paper production during that same year.

[15] Peter A. Victor, et al., op. cit., p.33.

A comparison of the environmental performance of British Columbia mills located beside marine waters with all other direct discharge mills in Canada is provided in Table 4:14. The contribution of British Columbia coastal mills to the total production of all direct discharge mills in Canada has declined by 0.1 percentage point over the period 1978 through 1985. The contribution of coastal mills to the total discharge loadings of all direct discharge mills in Canada has risen by 1.8 percentage points for total TSS, 2.8 percentage points for BOD, and 6.4 percentage points for toxicity. The environmental performance of British Columbia marine mills has not matched that of direct discharge mills located in other parts of Canada.

A comparison of the environmental performance of British Columbia's marine waters with other British Columbia mills is provided in Table 4:15. The comparisons provided in this Table show that the ten marine area mills in British Columbia accounted for 72.7 percent of the provinces total pulp and paper production during 1978. This contribution dropped to 54.8 percent in 1985. Over all, the total contribution of British Columbia coastal mills to provincial production fell by 17.9 percentage points over the eight year period shown on the Table. Despite this decline in total contribution to production, the share of TSS and toxicity loadings of those same mills rose by a percentage point change of 4.1 and 14.1 respectively. The BOD loadings declined by a percentage point change of 10.6 over all, but it is less than proportional to the

TABLE 4:14

A COMPARISON OF THE ENVIRONMENTAL PERFORMANCE OF BRITISH COLUMBIA'S MARINE WATER MILLS[1] WITH ALL OTHER DIRECT DISCHARGE MILLS IN CANADA 1978 THROUGH 1985

	1978 %	1985 %	Change in % Contribution Over Eight Year Period 1978 to 1985
Production	15.4	15.3	- .1
TSS	20.1	21.9	+ 1.8
BOD	10.5	13.3	+ 2.8
Toxicity (to fish)	19.8	26.2	+ 6.4

[1] The ten mills used to calculate the comparisons shown in this Table include by location: Elk Falls, Port Alice, Crofton, Powell River, Nanaimo, Woodfibre, Squamish, Port Mellon, Gold River, Prince Rupert, and Port Alberni.

Source: Environment Canada, Ottawa.

TABLE 4:15

A COMPARISON OF THE ENVIRONMENTAL PERFORMANCE OF BRITISH COLUMBIA'S MARINE WATER MILLS[1] WITH OTHER BRITISH COLUMBIA MILLS 1978 THROUGH 1985

	1978 %	1985 %	Change in % Contribution Over Eight Year Period 1978 to 1985
Production	72.7	54.8	- 17.9
TSS	73.3	77.4	+ 4.1
BOD	90.3	79.7	- 10.6
Toxicity (to fish)	70.6	84.7	+ 14.1

[1] The ten mills used to calculate the comparisons shown in this Table include by location: Elk Falls, Port Alice, Crofton, Powell River, Nanaimo, Squamish, Port Mellon, Gold River, Prince Rupert, and Port Alberni.

Source: Environment Canada, Ottawa.

daily average decline in total production.

The effluent waste discharge information contained in Tables 4:14 and 4:15 suggests that the coastal mills of British Columbia have not performed as well in reducing effluent discharges as mills in other parts of Canada. Unlike the situation in Quebec, where older and smaller producing sulphite mills are a major impediment to reducing effluent discharges, British Columbia marine mills (except for one mill) produce mainly kraft pulp. There is no evidence to suggest that mills in British Columbia are treated any differently than mills in other parts of Canada. However, even if such claims were true, additional emphasis on these mills might be considered justified on the basis of the comparisons undertaken in this section. There appears to be a substantial amount of unjustified resistance to adopting the necessary environmental controls among these mills. As noted in Chapter Two, both the willingness and ability of mills to adopt the required environmental safeguards is a major factor in determining the level of environmental performance within the pulp and paper industry. The information presented in this section, suggests that it also might be a contributing factor in the variations in environmental performance among mills located in different regions of Canada.

National and Regional Compliance with Federal Effluent Abatement Standards

Although there exists a number of legal and administrative complexities which make it difficult to enforce federal standards on an even-handed nation-wide basis (Chapter Three), EP has developed a number of mechanisms to encourage the adherence to federal minimum standards. As previously noted, EP uses the general provisions under the Fisheries Act to encourage adherence to federal minimum standards when appropriate. Both formal and informal arrangements have been made with the provinces to encourage industry's co-operation in meeting standards at least as stringent as those outlined under federal regulations. In addition, there are 51 mills in Canada which can be interpreted as coming under federal abatement regulations as they currently exist.[16] As a consequence, a very considerable portion of the industry are both directly and indirectly influenced by federal regulations.

Table 4:16, provides a comparison between 1978 and 1985 on the number and percentage of direct discharge mills considered in compliance with federal pulp and paper effluent standards for TSS and BOD. According to the information in this Table, 33.8 percent of the mills in Canada were in compliance with TSS federal standards in 1978, and 61.4 percent met federal standards in 1985. Over 59 percent of mills in Canada were in compliance with BOD federal standards in 1978, and 78.6 percent met federal standards in 1985. In terms of total numbers, the biggest improvement took place in Quebec where sixteen additional mills met TSS federal standards in 1985, and where only twelve met these same requirements in 1978. The number of Quebec mills that meet BOD federal requirements increased by ten over the same period. The percentage of mills in

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[16] It should be noted that the terms "considered" and "interpreted" are used, because it is not always possible to determine when a mill is in actual legal compliance with federal regulations on the basis information not specifically gathered for that purpose. In most cases, the tests undertaken do not conform to the requirements outlined under federal regulations. The Federal Government often obtains discharge information from the provinces, which do not have the same requirements as the Federal Government (See: Appendix I).

TABLE 4:16

COMPARISON BETWEEN 1978 AND 1985 ON NUMBER AND PERCENTAGE OF DIRECT DISCHARGE MILLS CONSIDERED IN COMPLIANCE[1] WITH PULP AND PAPER EFFLUENT REGULATIONS FOR TOTAL SUSPENDED SOLIDS (TSS) AND BIOCHEMICAL OXYGEN DEMAND (BOD) ACCORDING TO REGION

	1978					1985				
	Number of Mills	TSS		BOD		Number of Mills	TSS		BOD	
		#	%	#	%		#	%	#	%
British Columbia	22	3	13.6	19	86.4	23	10	43.4	23	100.0
Prairies	5	2	40.0	4	80.0	5	2	40.0	4	80.0
Ontario	29	15	51.7	19	67.9	28	24	85.7	23	82.1
Quebec	46	12	26.0	22	47.8	47	28	59.6	32	68.1
Atlantic	19	9	47.4	8	42.1	19	11	57.9	14	73.7
TOTAL	121	41	33.8	72	59.5	122	75	61.4	96	78.6

[1] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be an considered a violation under the law.

Source: Environment Canada, Ottawa. Information gathered in co-operation with regional environmental authorities and provinces.

compliance for TSS and BOD increased in every region except the Prairies over the eight years shown in the Table.

Table 4:17 provides a comparison between 1978 and 1985 on the number of direct discharge mills considered in compliance with federal acute toxicity requirements according to region. The information contained this Table shows that fourteen percent of all Canadian direct discharge mills were in compliance with federal toxicity standards in 1978, and almost 32 percent were in compliance with these same standards in 1985. The information in this Table shows, that there has been an increase in compliance for at least one mill in every region over the eight years shown in the Table. The biggest increase in toxicity compliance was in British Columbia. In terms of protecting the environment, the toxicity information contained in this Table is somewhat more important than the information provided on BOD and TSS above. Some provinces do not have their own federal toxicity requirements. Therefore, federal toxicity standards provide the only mechanism for regulating acute toxicity loadings within certain regions.

Table 4:18 is used to provide a comparison between 1978 and 1985 on the number and percentage of direct discharge mills considered in compliance with federal TSS and BOD standards by pulping process. Consistent with the information provided above on average daily loadings according to process, the information in this Table indicates the importance of the pulping process used and the environmental safeguards adopted in determining the environmental performance among segments within the

TABLE 4:17

COMPARISON BETWEEN 1978 AND 1985 ON NUMBER AND PERCENTAGE OF DIRECT DISCHARGE MILLS CONSIDERED IN COMPLIANCE[1] WITH PULP AND PAPER EFFLUENT REGULATIONS FOR TOXICITY[2] (TO FISH) ACCORDING TO REGION

	1978			1985		
	Number of Mills	Toxicity #	Toxicity %	Number of Mills	Toxicity #	Toxicity %
British Columbia[3]	22	1	4.5	23	10	43.4
Prairies	5	1	20.0	5	2	40.0
Ontario	29	5	17.9	28	8	28.6
Quebec	46	6	13.0	47	13	27.7
Atlantic	19	4	21.1	19	6	31.0
TOTAL	121	17	14.0	122	39	31.9

[1] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be an considered a violation under the law.

[2] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[3] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has a LC50 = 80, another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa. Information gathered in cooperation with regional environmental authorities and provinces.

TABLE 4:18

COMPARISON BETWEEN 1978 AND 1985 ON NUMBER AND PERCENTAGE OF DIRECT DISCHARGE MILLS CONSIDERED IN COMPLIANCE[1] WITH PULP AND PAPER EFFLUENT REGULATIONS FOR TOTAL SUSPENDED SOLIDS (TSS) AND BIOCHEMICAL OXYGEN DEMAND (BOD) ACCORDING TO PROCESS[2]

	1978					1985				
	Number of Mills	TSS		BOD		Number of Mills	TSS		BOD	
		#	%	#	%		#	%	#	%
Sulphite[3]	38	12	31.5	6	15.7	22	15	68.1	6	27.2
Sulphite/New Processes	3	1	33.3	0	0	6	3	50.0	3	50.0
New Processes	4	2	50.0	4	100.0	15	9	60.0	13	86.6
Kraft (Sulphate)[4]	42	13	30.9	36	85.7	45	24	53.3	42	93.3
Groundwood	6	1	16.6	3	50.0	7	3	42.8	7	100.0
Other Processes	28	12	42.8	23	82.1	27	20	74.0	25	92.5
TOTAL	121	41	33.8	72	59.5	122	75	61.4	96	78.6

[1] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be an considered a violation under the law.

[2] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (RMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

[3] Ontario has one mill which produces both kraft and sulphite pulp; it has been classified as a sulphite mill.

[4] In 1978, British Columbia had one mill which produced both kraft and new process pulp. In 1985, there were three mills which produced both kraft and new process pulp. In each case, these mills are classified as kraft mills.

Source: Environment Canada, Ottawa. Information gathered in co-operation with regional environmental authorities and provinces.

industry. Mills in all pulping process categories had a higher rate of compliance in 1985 than in 1978. Sulphite mills show an improvement in meeting total federal TSS standards over the eight years included in the Table. This improvement in TSS compliance can be attributed to the increased use of the primary clarifiers among sulphite mills in Canada. Despite this improvement, the percentage of sulphite mills considered in compliance for BOD generally is less than half that of the other processing categories included in the Table. There is not much doubt that the failure of these mills to install liquor recovery systems is the reason for the poor BOD compliance performance of sulphite mills.[17]

Table 4:19 is used to provide a comparison between 1978 and 1985 for compliance with federal acute toxicity standards among mills using different pulping processes. According to the information contained in this Table, there has been an increase in the number of mills in compliance for all processing categories over the past eight years. However, the rate at which mills are coming into compliance is slow. Only twenty of 45 kraft mills are considered in compliance with federal acute toxicity requirements.[18] During the past eight years, only one additional sulphite mill reduced its toxicity discharge to the point of meeting federal toxicity standards. One mill using a combination of sulphite and new processes is in compliance. Two mills using new processes and two mainly groundwood facilities are considered in compliance for acute toxicity.

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[17] The reader is referred to the reference to liquor recovery and BOD loadings on p.102 of Chapter Two.

[18] Once again, it should be noted that there are special problems with toxicity estimates provided here because they are based on the volume of water discharged and not necessarily on the quality of the toxicity properties contained in the effluent. This problem will be discussed later in Chapter Five.

TABLE 4:19

COMPARISON BETWEEN 1978 AND 1985 ON NUMBER AND PERCENTAGE OF DIRECT DISCHARGE MILLS CONSIDERED IN COMPLIANCE[1] WITH PULP AND PAPER EFFLUENT REGULATIONS FOR TOXICITY[5] (TO FISH) ACCORDING TO PROCESS[2]

	1978			1985		
	Number of Mills	Toxicity #	Toxicity %	Number of Mills	Toxicity #	Toxicity %
Sulphite[3]	38	1	2.6	22	2	9.0
Sulphite/New Processes	3	0	0	6	1	16.6
New Processes	4	0	0	15	2	13.3
Kraft (Sulphate)[4]	42	8	19.0	45	20	44.4
Groundwood	6	0	0	7	2	28.5
Other Processes	28	8	28.5	27	12	44.4
TOTAL	121	17	14.0	122	39	31.9

[1] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be considered a violation under the law.

[2] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation Process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

[3] Ontario has one mill which produces both kraft and sulphite pulp; it has been been classified as a sulphite mill.

[4] In 1978, British Columbia had one mill which produced both kraft and new process pulp. In 1985, there were three mills which produced both kraft and new process pulp. In each case, these mills are classified as kraft mills.

[5] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which the test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

Source: Environment Canada, Ottawa. Information gathered in cooperation with regional environmental authorities and provinces.

The number and percentage of new, altered, and expanded mills in each region, that are considered in compliance with federal effluent regulations are shown in Table 4:20.[19] This information reveals that 35 or 68.6 percent of all mills included under federal regulations are in compliance for TSS, 42 (82.3 percent) are in compliance for BOD, and seventeen (33 percent) are in compliance for acute toxicity. When the information in Table 4:20 are compared with the data provided in Table 4:16, it can be readily seen that mills considered subject to federal regulations have a better record of compliance for TSS and BOD than is true of the industry as a whole. However, a higher percentage of mills not subject to federal regulations are in compliance with the federal toxicity standard than is true of mills considered subject to federal regulations. It is likely this difference would be even more pronounced if federal authorities did not accept provincial standards as the basis for determining compliance with federal standards in some regions.[20]

The Relative Contribution of Government and Industry

The progress made during the last seventeen years in bringing the total of the industry under federal effluent regulations has been less than what many would consider ideal. A large proportion of the mills in the industry have not yet achieved compliance with the minimum standards prescribed under federal regulations. However, the success or failure of government efforts cannot be assessed solely on the basis of perceived compliance. At the time the effluent regulations were adopted in 1971,

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[19] The terms new, altered, and expanded are explained on pp.173, 203, and 204 of Chapter Three.

[20] These differences in toxicity standards are discussed in Appendix I.

TABLE 4:20

NUMBER AND PERCENTAGE OF NEW, EXPANDED AND ALTERED MILLS[1] CONSIDERED IN COMPLIANCE[2] WITH FEDERAL EFFLUENT REGULATIONS FOR TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND TOXICITY[3] (TO FISH) BY REGION - 1985

	Number of New, Altered or Expanded Mills	Considered in Compliance with Federal Regulations					
		TSS		BOD		Toxicity	
		#	%	#	%	#	%
British Columbia[4]	12	4	33.3	12	100.0	6	50.0
Prairies	1	1	100.0	1	100.0	1	100.0
Ontario	14	13	92.9	12	86.7	3	21.4
Quebec	16	11	68.8	10	62.5	4	25.0
Atlantic	8	6	75.0	7	87.5	3	37.5
Total	51	35	68.6	42	82.3	17	33.3

[1] New, Expanded and Altered as defined in federal effluent regulations.

[2] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be an considered a violation under the law.

[3] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[4] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have an LC50 = 30 requirement, one has a LC50 = 80, another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa.

government and industry efforts in controlling pollution were minimal.[21] Since that time there has been a marked increase in the amount of resources committed to pollution control by both government and industry (Figure 4:6). This is at least partially reflected in the number of direct discharge mills in Canada that have made major investments solely for the purpose of treating effluent. For example, in Tables 4:21(A) and (B) the number and percentage of mills in Canada with external treatment systems in 1987 are compared with the number and percentage having the such facilities for each of four different years since 1971. The British Columbia and Prairie regions, with relatively newer mills, have a comparatively large number of mills with external treatment. However, even in Ontario and the Atlantic regions, there has been an increase in the number of mills having external treatment. Quebec mills lag behind the rest of the country in the installation of external treatment systems, but once again, the circumstances of the industry in Quebec has made the installation of such facilities comparatively difficult.

As noted earlier in Chapter Three, the emphasis of federal environmental authorities is on the use of internal controls, in an effort to encourage the recirculation of waste material within the "factory fence". The efforts of industry to control waste internally is partially revealed by the information contained in Table 4:22. The information contained in this Table shows the estimated number of person-years, and concomitant wages and salaries, committed to control pollution within

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[21] The reader will recall from Chapter Three that the regulations were to be enforced in a manner which allows for economic adjustment to avoid social hardship. The difficulties associated with assessing social hardship, and the economic circumstances of individual mills, has to be considered important items in contributing to the slow rate of progress made by government in bringing industry into compliance.

TABLE 4:21(A)

THE NUMBER AND PERCENTAGE OF DIRECT DISCHARGE PULP AND PAPER MILLS WITH PRIMARY AND SECONDARY TREATMENT SYSTEMS[1] IN CANADA ACCORDING TO TIME PERIOD IN WHICH MILL COMMENCED OPERATION AND INSTALLED TREATMENT CONTROLS BY REGION TO 1987 (INCLUSIVELY)

	British Columbia					Prairies					Ontario				
	Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment		Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment		Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment	
		#	%	#	%		#	%	#	%		#	%	#	%
1971	20	8	40.0	5	25.0	4	3	75.0	2	50.0	27	5	18.5	0	0.0
1975	22	12	54.5	8	36.4	5	4	80.0	3	60.0	27	19	70.4	1	3.7
1981	22	17	77.2	11	50.0	5	5	100.0	4	80.0	28	24	85.7	1	3.6
1985	23	19	82.6	12	52.2	5	5	100.0	4	80.0	28	26	92.9	7	25.0
1987	23	19	82.6	12	52.2	5	5	100.0	4	80.0	28	26	92.9	7	25.0

[1] Includes partial or dedicated treatment systems

Source: Environment Canada, Ottawa.

TABLE 4:21(B)

THE NUMBER AND PERCENTAGE OF DIRECT DISCHARGE PULP AND PAPER MILLS WITH PRIMARY AND SECONDARY TREATMENT SYSTEMS[1] IN CANADA ACCORDING TO TIME PERIOD IN WHICH MILL COMMENCED OPERATION AND INSTALLED TREATMENT CONTROLS BY REGION TO 1987 (INCLUSIVELY)

	Quebec					Atlantic					Canada				
	Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment		Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment		Number of Direct Discharge Mills	Primary Treatment		Secondary Treatment	
		#	%	#	%		#	%	#	%		#	%	#	%
1971	44	6	13.6	2	4.5	18	3	16.7	3	16.7	113	25	22.1	12	10.6
1975	44	11	25.0	2	4.5	19	8	42.1	6	31.6	117	54	46.2	20	17.1
1981	47	19	40.4	4	8.5	19	12	63.2	6	31.6	121	77	63.6	26	21.5
1985	47	32	68.1	4	8.5	19	14	73.7	7	36.8	122	96	78.7	34	27.9
1987	47	36	76.6	4	8.5	19	14	73.7	7	36.8	122	100	82.0	34	27.9

[1] Includes partial or dedicated treatment systems.

Source: Environment Canada, Ottawa.

TABLE 4:22

ESTIMATED SALARIED AND HOURLY EMPLOYMENT[1] IN THE INDUSTRY[1] AND TOTAL PERSON-YEARS[2] DEVOTED TO POLLUTION CONTROL IN MILLS: PERCENTAGE OF TOTAL EMPLOYMENT AND REMUNERATION DEVOTED TO POLLUTION CONTROL - 1986

	Industry Employment and Remuneration ($000's)	Person-Years and Remuneration ($000's) Devoted to Pollution Control Within Mills in Industry	Environmental Control Employment and Remuneration as a Percentage of Total Employment/Income
Salaried Workers	16,788	275	1.6
Hourly Workers	70,603	727	1.0
Total Mill Employment	87,391	1,002	1.2
Wages and Salaries	2,511,617	28,797	1.2

[1] Employment represents only mill hourly and salaried workers and not wood employees.

[2] One person-year is equivalent to one person working full time for one year. A person-year does not necessarily imply that the total of the work was undertaken by the same individual. As an example, a person-year could be either two persons working full time for six months, or three persons working full time for four months.

Source: Industry and Provincial Agency Survey, 1987.

mills in Canada during 1986. It is shown that more than 1,000 person-years were used for pollution control purposes within pulp and paper mills nation-wide during 1986. Because this estimated total is calculated on a person-year basis, it can be readily submitted that the total number of employees who work at least some part of each day on waste discharge control within the industry is many times that number. The estimated portion of the total wages and salaries paid to employees for their pollution control responsibility is about 1.2 percent of the total annual wages and salaries paid to employees within the industry.

An estimate of the operational commitment by both the industry and government for controlling pollution in the pulp and paper industry is presented in Table 4:23. According to the information in this Table, EP had an assigned commitment of eighteen person-years for helping control pollution within the pulp and paper industry during the fiscal year ending in 1986.[22] This represented about 15.4 percent of the total number of person-years within the Federal Government with direct responsibilities for dealing with pollution control for all of Canadian industry. The provincial governments, together, had an estimated ongoing operational commitment of 28 person-years working for controlling pollution within the pulp and paper industry during the fiscal year ending in 1986. This represented about eighteen percent of the total provincial efforts for pollution control within all of industry nation-wide.

Estimates on the person-years used for research on pollution

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[22] Government person-year and salary figures are calculated on the basis of the fiscal allocations, as estimated by each individual province and federal regional environmental authorities. With only one pulp mill, Saskatchewan estimates were calculated from published financial statements provided by their representatives during the industry and provincial agency survey (See: Appendix I).

TABLE 4:23

COMPARISONS OF ESTIMATED ON-GOING EXPENDITURES[1] ($000's) BY GOVERNMENT AND THE PULP AND PAPER INDUSTRY ON POLLUTION ABATEMENT CONTROL (AIR AND WATER) IN CANADA - 1986

	Person-Years[3] Allocation		Salaries		Operational Expenditures	
	#	%	$	%	$	%
Federal Government[2]						
Total Industry	117		5,250		2,200	
Pulp and Paper Industry	18		775		270	
% Pulp and Paper to Total Industry		15.4		14.8		12.3
Federal Research Pulp and Paper Industry[5]						
Total Industry	48		1,800		1,200	
Pulp and Paper Industry	6		160		250	
% Pulp and Paper to Total Industry		12.5		8.9		20.8
Provincial Governments[2]						
Total Industry	156		6,705		1,802	
Pulp and Paper Industry	28		1,334		303	
% Pulp and Paper to Total Industry		18.0		20.0		16.8
Pulp and Paper Industry[4]						
Operational Commitment to Pollution Abatement Control at mill level	1,002		29,000		-	
Pulp and Paper Industry Research[5]						
Total Industry (Paprican)	90		11,511		6,776	
Pulp and Paper Industry	6		1,158		560	
% Pulp and Paper to Total Industry		6.7		10.0		8.3

[1] Expenditures do not include investment on capital or major equipment purchases.

[2] Government expenditures do not include emergency spill control or emergency operational cost estimates. Prince Edward Island expenditures on controlling industry pollution are not included in provincial expenditures category.

[3] One person-years is equal to one person working full time throughout one working year.

[4] Industry estimates do not include equipment repairs or spill clean-up work, electricity, land, taxes, spare parts or other treatment costs.

[5] Industry and government research includes only work undertaken by Pulp and Paper Research Institute of Canada, Burlington Environmental Technology Centre. Information on research undertaken by non-operational components within the provinces (i.e. provincial research establishments) are not included.

Source: Industry and Provincial Agency Survey, Environmental Protection Headquarters, Ottawa.

control by the pulp and paper industry and the Federal Government are calculated on the basis of work undertaken at the Burlington Environmental Technology Centre and the Pulp and Paper Research Institute of Canada. As revealed in Table 4:23, the Burlington Centre had six person-years committed to research on pollution abatement control within the pulp and paper industry during the fiscal year ending on March 31, 1986. This represented about 12.5 percent of the total commitment to research on pollution control within the industry during that year. The Pulp and Paper Research Institute devoted six person-years to research on pollution abatement control within the pulp and paper industry during the 1986 calendar year. This represented about 6.7 percent of all expenditures on research made by the pulp and paper industry through the Pulp and Paper Research Institute during that calendar year.

The estimates presented in Table 4:23 do not include the total amount of expenditures by either government or industry on pollution control for the pulp and paper industry. Industry has a number of technical committees, working groups and the like, which together with private consultants expend a considerable amount of effort on various aspects of pollution control on a part time basis during some part of each year. Estimates on the person-years actually committed to this type of work are not included in Table 4:23. Neither is the work of DFO, the Department of Justice, Indian and Northern Affairs, the National Research Council, and other national agencies included in the federal estimates. The provincial governments have agencies which mirror the efforts of the Federal Government within their jurisdictions. These commitments are not included in the provincial estimates shown in the Table. Nonetheless, the main thrust of the pollution control efforts by both levels of government are reflected in the estimates that have been provided. As such, the information contained in the Table can be considered a reasonably accurate and suitable basis for comparing the relative ongoing commitment by government and industry. It also serves as a reasonably accurate and suitable basis for comparing the relative ongoing commitment of the two levels of government.

On the basis of the comparisons provided in Table 4:23, an admittedly cursory assessment of the value received for money can be made. When it is assumed that the ongoing expenditures for the single year included in Table 4:23 are typical of the expenditures made by government and industry on an ongoing basis, it is possible to provide an indication of the annual cost of the average daily reductions achieved within the industry each year. For example, with an estimated annual total government ongoing operational expenditure of about $3.1 million by both levels of government, the total average daily TSS loadings by industry have been reduced by an average of 64 tonnes annually over the eight year period 1978 through 1985. The average daily loadings of BOD have been reduced by an average of 144 tonnes each year over the same eight year period. The average daily toxicity loadings have been reduced by about 376 thousand cubic meters per year over the eight year period ending December 31, 1985. In addition to TSS, BOD, and acute toxicity, there has been reasonable progress made in limiting the amount of air emissions and the effluents regulated by the provinces (i.e. pH and colour). Therefore, despite the inherent difficulty with such comparisons, it nonetheless can be concluded that very substantial accomplishments in reducing pollution from the pulp and paper industry have been made as a result of fairly modest ongoing annual commitment of government revenues.[23] In other words, it would appear that the Canadian taxpayer is receiving good value for the money committed each year by government for controlling pollution from the pulp and paper industry.[24]

When this same somewhat cursory comparative analysis is applied to industry, it can be concluded that the total reductions achieved within the industry has cost industry about $30 million annually in operational expenditures. Industry made an average annual capital investment on pollution controls for air and water of approximately $150 million per year over the eight year period 1978 to 1985. Despite the questions that can be raised about the accuracy of this information,[25] there is little doubt that pulp and paper manufacturers in Canada are making a major contribution to controlling their own pollution.

It is apparent that the provinces, the Federal Government, and industry have each made a contribution to the successful reduction of pollution from the pulp and paper manufacturing over the past seventeen years. The cooperative approach adopted by the Federal Government, during the early years when the pulp and paper regulations were first established, has been a factor in reducing the pollution caused by industry. As noted in Chapter Three, the cooperative arrangements established in consort with provincial authorities and industry have made it difficult to amend federal regulations and update standards. However, these same arrangements have helped to clarify a role for both levels of government and industry. This has reduced duplication of effort. On the basis of information presented in Table 4:23, these arrangements also appear to have contributed to the efficient use of limited resources.

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[23] The calculations used here include only estimated operational and research costs identified in Table 4:23, and not the government funded financial assistance programs outlined earlier on pp.181 to 185 of Chapter Three.

[24] The government financial assistance programs established to help the pulp and paper industry are not considered ongoing expenditure commitments.

[25] See: Appendix I.

Even a brief review of the documentation available from that time the federal effluent abatement regulations were first formulated reveals, that the standards adopted were consistent with the best information and technology available in the early 1970's. These standards have been used by most provinces for developing their own individual effluent requirements. These same standards and the air emission guidelines continue to be used by some provinces either as the main discharge limit for certain waste emission categories in provincial permits. In some situations the federal effluent control limits continue to be the only established standard for limiting certain effluents within some jurisdictions. Thus, the federal regulations and guidelines have undoubtedly helped to reduce the amount of pollution caused by the pulp and paper industry. However, by the very fact that both levels of government and industry have participated in reducing pollution over a more than seventeen year period, it is difficult to the point of being impossible, to measure the exact worth of any particular initiative. The only way to provide an indication of each participant's contribution is on the basis of what are necessarily the subjective views of those working in government and industry. The views of industry spokespersons and provincial government environmental authorities are provided in what follows.

The information contained in Table 4:24 is used to show the views of industry representatives and provincial environmental agency officials on the total progress made in reducing waste discharge from the pulp and paper industry over the past ten to fifteen years. According to this information, more than 65 percent of industry spokespersons feel that the progress made in reducing waste discharge has been good, very good, or excellent. Over 31 percent described the progress as fair. Only one industry spokesperson (or 1.8 percent of those responding from industry) described the progress as being poor. Over 62 percent of provincial officials feel that the progress has been good or better. Representatives for three of the eight provincial environmental authorities included in the survey feel that progress has been fair, but no provincial spokesperson is willing to describe the progress as poor.

The views of industry spokespersons on the combined contribution of government agencies to the progress made in waste management control during the past ten to fifteen years is presented in Table 4:25. According to the information recorded in this Table, 38 percent of industry spokespersons feel that industry would not have made progress without government participation. An equal percentage feel that government made an equal contribution with industry. The remainder, representing 24 percent

TABLE 4:24

PROGRESS MADE IN REDUCING WASTE DISCHARGE OVER THE LAST TEN TO FIFTEEN YEARS ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES AND PROVINCIAL AGENCY OFFICIALS[1] - 1987

	Progress Made In Waste Discharge Control[2]			
	Industry and Mill Representatives		Provincial Agency Officials	
	#	%	#	%
Excellent	2	3.5	0	0
Very Good	13	22.8	1	12.5
Good	23	40.4	4	50.0
Fair	18	31.6	3	37.5
Poor	1	1.8	0	0
No Opinion	0	0	0	0
	57	100.0	8	100.0

1 Saskatchewan provincial environmental agency officials did not comment.

2 Industry and mill representatives sometimes gave more than one answer to the progress made in reducing waste discharge (e.g. progress was very good during early years but during last five years progress in reducing waste discharge has slowed down considerably).

Source: Industry and Provincial Agency Survey, 1987.

TABLE 4:25

CONTRIBUTION OF GOVERNMENT TO THE PROGRESS MADE IN IMPROVED WASTE MANAGEMENT CONTROL IN THE PULP AND PAPER INDUSTRY DURING THE LAST TEN TO FIFTEEN YEARS ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES IN EACH REGION - 1987

	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada	
	#	%	#	%	#	%	#	%	#	%
Would Not Have Made Progress Without Government	7	63.6	3	25.0	6	35.3	3	30.0	19	38.0
Government Made Equal Contribution With Industry	2	18.2	4	33.3	10	58.8	3	30.0	19	38.0
Government Made A Contribution But Industry Would Have Progressed Without Help	2	18.2	5	41.7	1	5.9	4	40.0	12	24.0
Government Made Very Little or No Contribution	0	0	0	0	0	0	0	0	0	0
TOTAL	11	100.0	12	100.0	17	100.0	10	100.0	50	100.0

Source: Industry and Provincial Agency Survey, 1987.

of the total number included in the survey, feel that government helped but industry would have made progress without government assistance. Although industry respondents appear to underestimate the reluctance among some industry components to adopt the necessary environmental controls, no one from industry was willing to take the position that government made little or no contribution.

Table 4:26 is used to provide information on the views of industry and provincial representatives about the contribution of the Federal Government through the efforts of EP. Sixty-nine percent of industry spokespersons feel that EP has made an equal or better contribution with the provincial environmental authorities and industry. More than 62 percent (representing five of eight provinces) indicated that EP made an equal or larger contribution than that of industry and the provinces. The spokespersons from one province indicated that EP made a small contribution. The rather small response (only 29 of 50) among mill representattives can be attributed to the fact that the comments were made on a voluntary basis (the industry was not directly asked about federal contribution). Furthermore, many mill representatives deal only with the provinces, as a result of the "one window" approach which has been established within some jurisdictions.[26] It would seem reasonable to assume, that the six industry spokespersons who indicated that EP made no contribution, probably were isolated from direct involvement from federal

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[26] The "one window" approach is part of the cooperative arrangements which have been developed between Environmental Protection and the provincial environmental authorities in some regions. Under such arrangements, the provinces represent federal concerns by dealing directly with mill officials in order to reduce administrative overlap. These arrangements do not preclude federal agencies from dealing directly with mill operators when deemed necessary.

TABLE 4:26

CONTRIBUTION TO PROGRESS IN WASTE MANAGEMENT CONTROL WITHIN THE PULP AND PAPER INDUSTRY OVER THE LAST TEN TO FIFTEEN YEARS THAT IS ATTRIBUTED TO THE FEDERAL GOVERNMENT (EP) ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES[1] AND PROVINCIAL AGENCY OFFICIALS - 1987

	Industry Representatives		Agency Officials	
	#	%	#	%
Made the Most Contribution	0	0	0	0
Made a Major Contribution	4	13.8	1	12.5
Made an Equal Contribution With Province and Industry	16	55.2	4	50.0
Made an Important but Minor Contribution	3	10.3	2	25.0
Made a Small Contribution	0	0	1	12.5
Made No Contribution	6	20.8	0	0
Total	29	100.0	8	100.0

[1] Industry and mill representatives volunteered opinions on federal (Environmental Protection) contribution without being directly asked.

Source: Industry and Provincial Agency Survey, 1987.

officials as a result of indirect federal participation through the provinces.

Even though it is all but impossible to assign credit for the progress made in controlling pollution from the pulp and paper industry, it can be concluded on the basis of the foregoing that each level of government and industry have contributed to past achievements. Conversely, it can be said that any failures or lack of progress must be shared, as appropriate, by all three groups.[27] Industry is making the highest total expenditures for containing their own pollution. The comparison between the two levels of government on the committed ongoing expenditures for controlling pollution from the industry indicates that the participation of both were necessary for the regulative achievements of the past. This is supported by the views of industry and provincial agencies spokespersons as recorded in the information presented in this section.

Environmental Protection's Performance in Meeting the Goals Established by Government

The success of the pulp and paper effluent regulations and air emission guidelines, as with other government regulations and guidelines, necessarily depends on how well they have served their intended purpose. The goals established for the effluent abatement regulations were outlined by the Minister responsible for the adoption of the regulations in a series of statements before the House of Commons and before the Standing Committee on Fisheries and Forestry. These goals were clarified and expanded on in a number of speeches made prior to the adoption and introduction of amendments to the Fisheries Act of 1970.[28] The goals that were formulated during the period leading up to the adoption of effluent regulations were to:

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[27] The regulative duties of government ultimately does suggest a greater burden of responsibility for any lack of progress rests with government.

(1) Set in place a cooperative nation-wide framework, that would result in the gradual but steady reduction of pollution caused by the pulp and paper manufacturers in Canada over time.

(2) Provide minimum standards to prevent the possibility of pollution havens.

(3) Cause industry to assume a greater share of the costs and responsibility for protecting the environment.

(4) Ensure fairness of application of the regulations, that take into account the various processes used within industry.

(5) Cause industry to recirculate waste within the "factory fence" so that waste is treated before leaving the mill.

(6) Develop greater coordination among the various segments of industry, the provinces, and the Federal Government to reduce overlap and allow industry to operate in a stable economic climate.

The review and analysis undertaken in the earlier part of this Chapter and Chapter Three, indicates that all of these basic goals have been achieved. The cooperative arrangements that were envisioned by

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[28] Parliamentary Hansard, House of Commons Debates, Government Organisation Act, The Honourable Jack Davis, January 27 1971. Jack Davis, Regional Liberal Conference, September 26 1970. Jack Davis, Minister of Fisheries and Forestry, an address to the Fraser Valley Regional Conference, Langley, B.C., October 3 1970. J.L. Keays, K. Jackson, Effluents Standards for Canadian Pulp and Paper Industry, Report on Recommendations of Regulations Development Committee, January 1970.

Mr. Davis (the first Minister of Fisheries and the Environment appointed after the passage of the Government Organisation Act of 1970) have been established. There are no pollution havens for the pulp and paper industry in Canada. Mills in every region in Canada contribute to controlling the pollution which is caused by manufacturing pulp and paper. The industry has placed emphasis on recirculating waste within the "factory fence", so that the total amount of effluent released into the environment has been greatly reduced. The total ongoing operational expenditures by mills in Canada are estimated to be in the neighbourhood of about $30 million annually. The level of cooperation between the federal and provincial governments has been such, that the pollution control requirements of the two levels of government are either the same or at least consistent. The actual number of agencies dealing directlv with mill operators on pollution matters has been reduced because of better coordination over time.[29] Despite complaints to the contrary, the standards outlined in the regulations have been enforced fairly, while taking into account the various pulping processes used within the industry.[30] There has not been a single economically viable manufacturing operation within the pulp and paper industry forced to close as a result of having to meet the federal effluent control standards.

Although there are those who might criticise the fact that the total of the industry has never been brought under the effluent abatement regulations, no time limit was ever set for bringing the total of the industry under the regulations. The rather slow progress in bringing mills subject to the regulations into compliance, can be attributed to the special circumstances, which federal administrators are specifically required to take into account under the terms and conditions outlined when the regulations were first adopted. Sulphite mills have not matched the progress made by mills using other pulping processes in achieving compliance. However, neither has any community, in which a sulphite mill is located, been subjected to social economic hardship that could result if a pulp and paper mill were to close because it does not meet the federal standards. Even though the somewhat contradictory nature of the goals themselves, has led to numerous administrative difficulties over the years, substantial progress has been made in reducing the pollution from the industry, and both industry and provincial governments place value on the contribution of EP and the Federal Government. Therefore, it can be concluded on the basis of the original goals established at the time the regulations were first introduced and adopted, the pulp and paper effluent regulations have been a success.

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[29] See: Table 3:2, p.216.
[30] See the discussion on p.274.

The somewhat more modest and less complex goals of the pulp and paper air pollution guidelines are described in the various Environmental Protection Service documents published since 1971. The specific goal of the guidelines is to promote the uniform approach to pollution control in Canada, as authorised under the Clean Air Act to develop and publish national emission standards. The guidelines are set out as emission limitations which might be used as national "baselines" and considered by provincial governments as minimum standards on which to base their regulations.[31] Although the guidelines are not as valued as the effluent pollution regulations by either industry or provincial environmental authorities,[32] to the degree that the guidelines have influenced the standards adopted by the various provincial authorities, they serve their intended purpose. As noted previously, some smaller provinces continue to use the air emission guidelines for setting air contaminants emission limits within their jurisdictions. The air emission guidelines can be considered successful, because they serve their intended purpose.

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[31] R.M. Benjamin, Air Pollution Emissions and Control Technology: Wood Pulping Industry, Economic and Technical Review Report EPS3-AP-77-6, Air Pollution Control Directorate, March 1979, p.42.

The Continued Use of the Administrative Approach Originally Adopted by the Federal Government

The all encompassing and complex goals that were articulated as broad overall objectives for the administration of the effluent abatement regulations in the early 1970's are in many respects contradictory and require careful interpretation.[33] Nonetheless, the basic intention of those who formulated the principles on which the regulations were established is clear. The regulative program which was established to reduce pollution from the pulp and paper industry is consistent with the established principles. Standards were to be minimal requirements that could be enforced nation-wide. Regulations were to compliment, what was anticipated would be the more stringent requirements of the provinces. The industry was to assume a greater share of the costs for reducing their own pollution. Over the intervening years since 1971, the total amount of waste discharged from the pulp and paper industry has been substantially reduced. Most provinces have established regulations of their own, which are applied to mills within their jurisdictions. The vast majority of industry now recognises the need to protect the environment, and have made substantial expenditures on pollution control. At least on surface, it would appear that the need for direct federal involvement has diminished.

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[32] See: Table 3:9 in Chapter Three, p.227.

[33] For example, the even-handed application of minimum nation-wide standards cannot be fully achieved if those responsible for administering the regulations are required to make allowances for the different pulping processes used within the industry. The difficulties encountered by those responsible for enforcing the regulations as a result of these contradictions are discussed later in Chapter Six.

Aside from the rather obvious jurisdictional responsibilities[34] which necessitate federal participation in protecting the environment,[35] there are a number of compelling reasons for continued federal participation in controlling pollution within the pulp and paper industry. The first and most obvious of these is the ever increasing concern among Canadians about industry pollution. Regardless of jurisdictional niceties, "government" is expected to respond.[36] A recent statement by Ontario's Minister of the Environment reflects his views on the growing concern of the public about environmental issues. The Minister stated:

> There is good reason .... to treat environmental issues seriously: Last year pollution played a major role for the first time in a provincial election.[37]

This coupled with the increasing number of public requests for direct federal intervention on specific environmental issues suggests that Canadians expect Ottawa to work with other levels of government to protect natural ecosystems. It would appear that the public recognises that each level of government, within their own jurisdictional prerogative, has a role to play in protecting the environmental interests of Canadians.

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[34] The jurisdictional responsibilities of the Federal Government as they relate to protecting the environment, as well as industry waste control, are discussed in Chapter Three.

[35] The need for government intervention to protect the public from industry pollution was discussed throughout Chapter Two. The national and regional approaches to pollution control are discussed on pp.143 to 148 of Chapter Two.

[36] Decima Research, "Report to Environment Canada on Nation-wide Survey on Attitudes Towards Environmental Priorities", September 1987, 60p.

[37] Michael Keating, "Where There's Smoke: Pollutors Beware: Cleaning Up the Environment is an Ontario Priority", The Globe and Mail, Toronto, August 9 1986, p.A4.

Related to this issue also is the nation-wide impact that pulp and paper manufacturing can have on resources and the environmental well-being of the nation. Aside from the vast amounts of timber used in manufacturing, the pulp and paper industry is a major consumer of water. For example, it has been estimated that the nine kraft mills in Ontario use water volumes equivalent to that required by a city of two million people.[38] The pulp and paper industry is the second highest consumer of energy among Canadian manufacturers.[39] A major portion of the chemical industry is dependent on the pulp and paper industry for existence. The overall direct and indirect potential impact that pulp and paper manufacturing can have on the environment is enormous.[40]

The relative importance of the national and regional environmental concerns about pulp and paper manufacturing are revealed by the information contained in Table 4:27. This Table is used to rank the relative significance of the pulp and paper industry among all other indus-

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[38] Norman Bonsor, Neil McCubbin, and John B. Sprague, Stopping Water Pollution At Its Source: Kraft Mill Effluents in Ontario, report prepared by Expert Committee on Kraft Mill Toxicity for the Technical Advisory Committee, Pulp and Paper Sector of MISA, Ontario Ministry of the Environment, Toronto, April 1988, p.2-21.

[39] A.J. Ewing, Energy Efficiency in Pulp and Paper Industry with Emphasis on Developing Countries, Washington, D.C., World Bank, Technical Report No. 34, February 1985.

[40] The use of water and energy both impact directly and indirectly on fish. Water withdrawals from lakes, rivers, and streams impact on resident fish populations in areas where mills are located. Hydro-electric developments can serve as impediments to the passage of anadromous fish species, which are the responsibility of the Federal Government. There are as well the very substantial implications for water quality and the domestic use of water within certain areas.

TABLE 4:27

THE RATED[1] RELATIVE SIGNIFICANCE OF SELECTED INDUSTRIES[2] AS WASTE DISCHARGE PROBLEMS IN EACH OF NINE PROVINCES ACCORDING TO PROVINCIAL ENVIRONMENTAL OFFICIALS - 1987

Province Industry	British Columbia	Alberta	Sask.	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Nfld.
Pulp and Paper	1	6		3	3	3	1	6	2
Smelting and Refining	4				5	2	6		5
Cement Manufacturing				10	8	8		7	
Chemical	3			2	1	1	7		3
Agriculture		1	2	5					4
Municipal	5	3		4	6	7	4	2	
Food Processing				9					
Mining (Primary)	2	2	1	1	4	4	3	3	1
Meat and Poultry				7					
Petroleum		4		8	7	5	5	8	6
Iron and Steel					2	6		1	
Lime Manufacturing						9	8		
Storage Tanks (groundwater)							2	4	
Hazardous Chemical (general)								5	
Petro-Chemical		5							
Creameries				6					

[1] Ratings are based on an ordinal relationship with 1 being the most important through to 10 which is least important.

[2] The industry categories are not necessarily mutually exclusive of one another, but are accurate in terms of provincial respondents choice of industry identification classification.

Source: Industry and Provincial Agency Survey, 1987.

trial sectors for each province in Canada on the basis of the views of the provincial environmental authorities. According to the information presented in this Table, the problems associated with waste discharge from the pulp and paper industry are the major industry related environmental concern in British Columbia and New Brunswick. The pulp and paper industry is the second major industrial pollution concern in Newfoundland. In Ontario and Quebec the pulp and paper industry ranks third. Only the chemical industry (which as already noted above is a major supplier of the pulp and paper industry) and the mining industry are rated as high for pollution abatement concerns as the pulp and paper industry nation-wide.

Although many provinces have adopted industry regulations of their own since 1971 and the total expenditure by governments on controlling pollution from the pulp and paper industry are proportional to pollution problems caused by industry nation-wide (Tables 4:27 and 4:23), with but one exception provincial environmental authorities want continued federal involvement. The larger provinces continue to have a concern for the very major cost of research and technology transfer (often from foreign sources), which have been part of the activities of EP over the years. Practically all provinces recognise the difficulties associated with maintaining the expertise necessary to address the complex pollution problems of the pulp and paper industry. They want continued access to the expertise and experience now available within EP. The environmental authorities in one province want EP to continue to work in partnership with them, because with a limited number of mills they do not feel they can justify the expense of maintaining the support of staff, and acquiring the professional expertise, required to ensure adequate protection for the environmental concerns of those living within their province. The provinces and industry also share with the Federal Government a concern for the use of consistent, but not necessarily the same standards, for waste discharge controls across the country.

The importance which industry and provincial representatives place on maintaining consistent pollution control standards across the country is shown in Table 4:28. According to the information in this Table, environmental authorities in all provinces feel that it is important to maintain some level of consistency for environmental controls within Canada. Eighty-four percent of all industry and mill representatives consider it important or very important. With the exception of Ontario industry representatives, there appears to be overwhelming support within both government and industry for maintaining consistent environmental standards among and between provinces.[41]

The information contained in Tables 4:29(A) and (B) is used to provide a comparison between the federal and provincial discharge requirements for TSS and BOD according to region. This comparison reveals that the provincial requirements for TSS are more stringent for some mills in every region except British Columbia.[42] In every province with the

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[41] All Ontario industry representatives included in the survey expressed some concern about the MISA program being used by the federal officials to adopt more rigid federal standards nation-wide. Since many companies operating in Ontario have mills in other locations in Canada, the representatives of these companies could be expected to have strong views about any changes in standards, which affect their overall operations.

[42] See discussions on variations in TSS measurements among the provinces in Appendix I. It is interesting to note from Figures 4:3 and 4:4, that the limits prescribed by provincial authorities appear to vary directly with relative loadings levels of each of the major producing provinces.

TABLE 4:28

THE IMPORTANCE OF MAINTAINING CONSISTENCY IN PULP AND PAPER INDUSTRY ENVIRONMENTAL CONTROL STANDARDS ACROSS CANADA ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES AND PROVINCIAL AGENCY OFFICIALS - 1987

	Industry and Mill Representatives										Agency Officials	
	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada		Provinces	
	#	%	#	%	#	%	#	%	#	%	#	%
Very Important	4	36.4	1	8.3	0	0	4	40.0	9	18.0	3	33.3
Important	7	63.6	6	50.0	16	94.1	4	40.0	33	66.0	6	66.7
Not Important	0	0	5	41.7	1	5.9	2	20.0	8	16.0	0	0
TOTAL	11	100.0	12	100.0	17	100.0	10	100.0	50	100.0	9	100.0

Source: Industry and Provincial Agency Survey, 1987.

TABLE 4:29(A)

COMPARISON OF PROVINCIAL AND FEDERAL DAILY DISCHARGE LIMITS ON TOTAL SUSPENDED SOLIDS (TSS) LOADINGS FOR DIRECT DISCHARGE MILLS IN CANADA ACCORDING TO REGION OF LOCATION - 1985

	TSS										Total Canada	
	British Columbia		Prairies		Ontario		Quebec		Atlantic		TSS	
	#	%	#	%	#	%	#	%	#	%	#	%
More Stringent than Federal Requirements	0	0	1	20.0	17	60.7	36	76.6	2	10.5	56	45.9
Less Stringent than Federal Requirements	22	95.7	1	20.0	2	7.1	11	23.4	2	10.5	38	31.2
Equal to Federal Requirements	1	4.3	2	40.0	2	7.1	0	0	15	79.0	20	16.4
Information not Available	0	0	1	20.0	7	25.0	0	0	0	0	8	6.6
Total	23	100.0	5	100.0	28	100.0	47	100.0	19	100.0	122	100.0

Source: Report on the 1985 Industrial Discharge in Ontario, Ontario Provincial Government, and Department of Environment, Ottawa

TABLE 4:29(B)

COMPARISON OF PROVINCIAL AND FEDERAL DAILY DISCHARGE LIMITS ON BIOCHEMICAL OXYGEN DEMAND (BOD) LOADINGS FOR DIRECT DISCHARGE MILLS IN CANADA ACCORDING TO REGION OF LOCATION - 1985

	BOD										Total Canada	
	British Columbia		Prairies		Ontario		Quebec		Atlantic		BOD	
	#	%	#	%	#	%	#	%	#	%	#	%
More Stringent than Federal Requirements	19	82.6	2	40.0	10	35.7	19	40.4	5	26.3	55	45.1
Less Stringent than Federal Requirements	4	17.4	0	0	7	25.0	27	57.5	0	0	38	31.2
Equal to Federal Requirements	0	0	2	40.0	3	10.7	1	2.1	14	73.7	20	16.4
Information not Available	0	0	1	20.0	8	28.5	0	0	0	0	9	7.4
Total	23	100.0	5	100.0	28	100.0	47	100.0	19	100.0	122	100.0

Source: Report on the 1985 Industrial Discharge in Ontario, Ontario Provincial Government, and Department of Environment, Ottawa.

exception of Quebec, provincial BOD requirements for most mills are more stringent than federal loadings limits. However, for more than 31 percent of all mills nation-wide, federal requirements for TSS and BOD exceed that of the provinces. Although comparative information for acute toxicity loadings is not presented, it is known that in at least one province there does not exist a proclaimed toxicity discharge limit, which can be applied independently of the federal requirement.[43] In most cases where an individual province has not adopted a discharge limit for an effluent included under federal regulations, the province will recognise the federal standard as the appropriate control limit for mills within its jurisdiction. Unfortunately, in most cases federal standards are not enforced by provincial environmental authorities, even though regional federal officials may depend on the province to enforce standards at least as stringent as those of the Federal Government.[44] Since the provinces generally use federal standards as a guide for setting discharge limits, and the federal regulations were established to compliment the efforts of the provincial governments, the regulations are being used as intended. However, as enforceable requirements, which are applied consistently on a nation-wide basis for the purposes of preventing pollution havens, there is room for improvement.

The importance of preventing pollution havens should not be underestimated. As reflected in the information presented in Table 4:28, the provinces do not want their industrial constituents, or environmentally concerned residents, to share disproportionally in the losses which can result from the trade-offs between economic growth and a healthy environment. Regional components of the industry want the opportunity to compete on an equal footing with their competitors located in other parts of the country. If it were otherwise, then it could be assumed that the costs of adopting environmental controls are not a major expense, which affects economic viability as claimed by industry. Therefore, to the degree that environmental expenditures affect profitability within the industry, different standards in different parts of the country affect the ability of companies to pay dividends, compete in the marketplace, and to raise capital. On a nation-wide basis, this can result in making it difficult for some regions to attract new mill operations, maintain local or regional incomes at levels comparable with the national average, sustain regional job opportunities, and share equally in national economic growth.[45] It is in the interest of all Canadians to have some minimal level of consistency among the regions for the pollution control standards applied to Canada's pulp and paper industry.

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[43] The variations are sufficiently great to preclude the use of generalisations to describe the collective provincial approach. Many provinces (including Quebec and Ontario) do not have formal legislation requiring non-lethal effluents. However, most specify a toxicity limit in their permits. Some Ontario control orders require a continuous flow test. Norman Bonsor, et al., op. cit., p.7-131. See: Appendix I.

[44] A province usually will enforce the standards specified in a mill permit, but this standard is not always as stringent as the federal requirement.

While there is no evidence that prior to the adoption of the effluent pollution regulations, less stringent control measures were used by the provinces to attract industry, the same is not necessarily true at the municipal level. Some observers feel that at one time it was commonplace for Canadian municipalities to use less stringent local environmental requirements to attract manufacturing which would increase the municipal tax base to create employment.[46] Similar observations have been made in the United States. For example, it was observed that before 1972 and the amendments to federal water pollution control legislation,[47] some "states had allowed liberal pollution laws in order to attract industry".[48] While this may or may not prove to be a problem in Canada in future, it follows that the federal government with its responsibilities for the cross-boundary implications of pollution, and its obligations to protect the national interest, has a duty to ensure some minimal level of nation-wide consistency in the application of industry pollution regulations.

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[45] As noted in a recent report prepared for the Ontario Ministry of the Environment: "in the absence of uniformly enforced environmental regulations, industry cannot be expected to commit resources to environmental protection". Norman Bonsor, et al., op. cit., p.l.l.

The amount of effluent dumped into the Canadian waters by the pulp and paper industry has been reduced substantially over the years since 1971. The attitude of the industry about the need to protect the environment has improved, and many of the provinces have adopted industry regulations to control the waste discharges within their jurisdictions. With all of these changes, there inevitably is the need to redirect the focus of federal efforts in protecting the environment. However, this does not alter the basic importance of the initial objectives established by the Federal Government to protect Canadians from industrial pollution in the national interest. The original commitment of the Federal Government to protect the right of the provinces to share equally in the opportunity to acquire new industry (and provide employment) and the right of Canadian citizens to live in an environment which is at least as pristine as that of their neighbours remain worthwhile objectives. The regulative activities of the Federal Government are as necessary and appropriate today as they were seventeen years ago when the pulp and paper regulations were first introduced.

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[46] H.A. Hosse, et al., "The Multiple Use of Resources: Policy Making in Administration", Anthony DeVos, et al., Pollution Reader, Harvest House, Montreal, 1968, p.202. This was also a concern of the Honourable Jack Davis, as recorded in Parliamentary Hansard, January 27 1971, p.2830.

[47] United States Federal Water Pollution Control Act, Amendment PL92-500.

[48] Allan M. Springer, Industrial Environmental Control: Pulp and Paper Industry, John Wiley and Sons, New York, 1986, p.44.

Summary

Over the period 1970 to 1985, the average daily production of direct discharge mills in Canada rose by 16,470 tonnes or 31 percent. During this same period, average daily TSS discharges from these same mills decreased by 1,328 tonnes or 62 percent, average daily BOD loadings declined by 1,360 tonnes or 40 percent, and the average daily volume of acute toxicity loadings fell by 3,022 thousand cubic meters or 31 percent. These very substantial decreases in effluent loadings took place in every region, with the largest loadings reductions for BOD and toxicity occurring during the period 1978 to 1985. Except for BOD loadings in British Columbia (where BOD loadings are low), and to a much lesser extent the Prairies for toxicity and BOD (where loadings are also small), mills in all regions reduced their loadings consistently throughout the entire period 1970 to 1985. Although many mills are discharging wastes well above the limits prescribed in federal regulations, the industry as a whole is approaching the average daily loadings level necessary to achieve nation-wide compliance with the federal standards for both TSS and BOD.

Although the air contaminants emissions from the pulp and paper industry are small in comparison to the emissions from other sources, the industry's performance in controlling the releases of disruptive substances into the atmosphere is good. The total of the estimated common air contaminants from all mills in the industry either remained the same or have decreased slightly over the period 1970 to 1986. Mills in every region have made progress in controlling their air emission contaminants. When viewed in light of the production increases that took place within the industry over the seventeen year period ending in 1986, it can be readily determined that there has been considerable progress made in reducing air emissions on a per tonne of production basis. The progress made in this area is likely to proceed more rapidly over the next few years, as a result of the apparent commitment by industry to further reduce the air emissions from individual manufacturing facilities.

The review and analysis undertaken in this Chapter and Chapter Three indicates that all the original goals set for the effluent abatement regulations have been achieved. The cooperative arrangements that were envisioned by those who sponsored the regulations in 1971 have been established. There are no pollution havens for the pulp and paper industry in Canada. Mills in every region in Canada contribute to the controlling the effluent discharges caused as a result of manufacturing pulp and paper. The industry has placed emphasis on recirculating waste within the "factory fence", so that the total effluent released into the environment has been reduced. Industry has assumed a much greater share of the costs and responsibility for protecting the environment. The level of cooperation between the federal and provincial governments has been such that the pollution control requirements of the two levels of government are either the same or at least consistent. The actual number of agencies directly dealing with mill operators on pollution matters has been reduced because of better coordination. Despite complaints to the contrary, the standards outlined in the regulations have been enforced fairly, while taking into account the various pulping processes used within the industry. There has not been a single economically viable manufacturing operation forced to close as a result of having to meet the standards specified under federal regulations.

The specific goal of the air emission guidelines is to promote a uniform approach for pollution control in Canada, and as authorised under the Clean Air Act, to develop and publish national emission standards. The guidelines are set out as suggested air emission minimal limits, which can be used by provincial authorities for setting their own enforceable standards. Although the guidelines are not as valued as the effluent pollution regulations by either industry or the provincial environmental authorities, to the degree that the guidelines have influenced the standards adopted by the various provinces, they have served their intended purpose. Some smaller provinces continue to use the air emission guidelines as the basis for setting enforceable air contaminant emission limits within their jurisdictions. The air emission guidelines continue to serve the purpose for which they are intended, and therefore, are successful.

The information presented in this Chapter on capital investment by industry for controlling effluent and air contaminants discharges indicates that the industry spends a substantial amount of money on pollution control each year. During the early 1970's, mills in British Columbia made the highest total annual investment for controlling discharges into both air and water. In more recent years (1978 to 1984), the capital expenditures by British Columbia mills for effluent control has declined in comparison with other regional components of the industry, while the capital investment of these same mills on air contaminants control has remained relatively high. The modernisation program appears to have influenced the amount of capital investment made on pollution control for mills in Quebec, Ontario, and the Atlantic provinces. The greatest impact of this program appears to have been on the amount of investment made in controlling air emissions. Ontario mills were making comparatively large capital investments for controlling effluents even prior to the introduction of the modernisation program, while the amount of capital investment on effluent control by Atlantic mills actually declined during the early years of the modernisation program. The overall average proportion of total capital investment made by industry for controlling pollution slowly decreased over the period 1973 to 1983. However, regardless of the motivating factors and the relatively minor decline in the proportion of total investment actually committed to pollution control, it is clear that mills in every region are making large investments for the purpose of controlling effluent and air contaminant discharges.

Estimates on the total operational commitment of industry and government are provided for 1986. These operational estimates are viewed as ongoing annual commitments, which are representative of the expenditures made over a number of years. On this basis, it is estimated that more than 1,000 person-years are used by industry for controlling pollution within pulp and paper manufacturing facilities each year. The wages and salaries associated with this operational commitment of 1,000 person-years amounts to $30 million annually, and is approximately 1.2 percent of the total annual wages and salaries paid to mill workers in Canada. When industry capital investments are added to the estimates on operational expenditures, the total annual expenditure by industry on pollution control can be estimated to be about $180 million annually. Even though this does not represent all of the annual expenditures by industry (because of committee work and the like), these less than perfect estimates indicate that industry is making a large effort to control its own pollution.

The Federal Government uses about 18 person-years annually for the purpose of controlling pollution within the pulp and paper industry. This represents about 15.4 percent of the total number of person-years used by the Federal Government for dealing with the pollution problems caused by all of Canadian industry. The provincial governments together, make a combined estimated annual ongoing operational commitment of 28 person-years for the purposes of controlling pollution from the pulp and paper industry. This represents about eighteen percent of the combined provincial effort for pollution control within all of Canadian industry.

These estimates for government do not represent all of the expenditures made by either level of government for controlling waste within the pulp and paper industry. Nonetheless, a major portion of the annual ongoing operational commitment of the federal and provincial governments are included in these estimates. As such, this information can be viewed as a reasonably accurate indication of the relative overall expenditure by the two levels of government. When the size of the ongoing expenditures by government (both federal and provincial) for controlling pollution within the pulp and paper industry are compared with the industry's importance as a source of industrial pollution, it becomes apparent that the amount of commitment by government does not appear excessive to the importance placed on this problem by environmental officials nation-wide. The actual results achieved, because of government efforts, have been fairly substantial for what appears to be a rather modest amount of annual government expenditure. When the potential pollution problems caused by the industry are taken into account, there appears to be little doubt that the taxpayers of Canada are receiving good value for the roughly $3.1 million spent annually by governments for controlling pollution from the pulp and paper industry.

The federal expenditures are of sufficient relative magnitude to indicate that the participation of both levels of government is necessary to control pollution from the pulp and paper industry. This is confirmed by information gathered during a survey of industry and provincial representatives, which was undertaken in conjunction with this study. Industry spokespersons believe that government efforts have been necessary to the environmental accomplishments of the industry during the past ten to fifteen years. Those industry representatives who deal directly with EP personnel believe that the Federal Government has made a contribution to the work of the provinces and industry. More than half of industry and government are willing to credit the contribution of EP efforts as being equal with that of the provinces and industry. As can be discerned from the information presented in this Chapter, and will be confirmed by information subsequently presented in this report, both industry and the provinces acknowledge and place value on the role that EP has played in helping to control pollution within the pulp and paper industry. Since many provincial environmental officials (of both large and small provinces) are emphatic about the need for both levels of government to continue working to solve the complex problems posed by the industry, there does not appear to be much doubt that EP is expected to take an active role in helping to control the pollution caused by pulp and paper manufacturers. It is unlikely that future progress will match the accomplishments of the past, unless EP continues to take an active role.

Despite substantial progress, mills in all regions have not been equally successful in reducing effluent loadings over the years. As would be expected, regional effluent discharges are highest in regions which collectively account for the highest production levels. However, there is considerable variation in the environmental performance among mills in different regions. As revealed by the information and analysis presented in this Chapter, these variations cannot be explained on the basis of production levels or the types of products produced. Quebec direct discharge mills accounted for 32 percent of the average daily total tonnage of final product produced by all of Canada's direct discharge mills during 1985. These same mills accounted for 48 percent of the industry's average daily loadings of BOD, 40 percent of the average daily volume of acute toxicity releases, and 38 percent of the total average daily TSS discharges during that same year. While the large number of sulphite producing mills located in Quebec does help to explain some of the difficulties associated with reducing pollution, it does not provide a satisfactory explanation for the generally lower performance of this group of mills in comparison with other regions in Canada. The effluent control problems caused by sulphite pulping mills are limited mainly to BOD and toxicity (68 percent of Canada's sulphite mills are in compliance for TSS). Sixty-eight percent of Quebec mills are in compliance with Federal regulations for BOD, 28 percent are in compliance for acute toxicity, and over 59 percent are in compliance for TSS. More than 23 percent of the mills located in Quebec have less stringent provincial discharge limits for TSS than the minimal limits specified under federal regulations. Approximately 57 percent have less stringent requirements for BOD.

British Columbia direct discharge mills accounted for 28 percent of the total final product produced by all direct discharge mills in Canada during 1985. These same mills accounted for 28 percent of the industry's average daily TSS daily discharge, 31 percent of acute toxicity loadings, and a modest eighteen percent of the BOD releases during 1985. All mills in British Columbia are in compliance with BOD standards. However, only 43 percent of British Columbia's mills are in compliance with federal standards for TSS and acute toxicity. Almost 96 percent of British Columbia mills have less stringent provincial discharge limits for TSS than those specified under federal regulations. Many British Columbia mills also have less stringent toxicity limits. The overall performance of British Columbia mills is influenced by the comparatively poor performance of ten coastal mills.

Ontario accounted for 21 percent of the total production of direct discharge mills in Canada during 1985. These same mills were responsible for less than thirteen percent of the average daily discharge of TSS, eighteen percent of the average daily loadings of BOD, and less than sixteen percent of the average daily volume of acute toxicity loadings. More than 80 percent of Ontario mills are in compliance with federal effluent TSS and BOD discharge standards. Twenty-nine percent are in compliance with federal toxicity standards. Only seven percent of the mills in Ontario have less stringent provincial requirements than those specified under federal regulations for TSS, and only 25 percent have less stringent requirements than those specified under federal regulations for BOD. All mills in Ontario are required to meet toxicity limits at least as stringent as those outlined in federal regulations, when using a static test.

The combined production of the Atlantic and Prairie region direct discharge mills accounted for somewhat less than nineteen percent of the total production from similar mills in other parts of Canada during 1985. Except for TSS loadings in the Atlantic region, the collective TSS and BOD loadings in these two regions was less than proportional to their combined contribution to total production. Forty percent of the Prairie mills and 58 percent of the mills in the Atlantic meet federal TSS discharge limits. Eighty percent of the mills on the Prairies and 74 percent of the mills in the Atlantic region meet BOD federal standards. Only four of the 24 direct discharge mills in these two regions have less stringent provincial requirements for TSS than those specified under federal regulations. All mills in both regions have either equal or more stringent requirements for BOD than those specified under federal regulations.

The level of compliance among Canadian mills with federal minimum standards cannot be described as poor, but it does not appear to be as high as might be expected after sixteen years. Compliance among those mills, which are considered subject to federal regulations is less than total. In fact, only one-third of all mills considered new, expanded, or altered are in compliance with the federal acute toxicity standard (using a static test). As has been emphasised throughout this report, the single most important factor in determining the level of effluent loadings from a pulp and paper mill are the pulping processes employed within the mill operation. This is supported by information presented in this report on the environmental performance of sulphite mill operations. However, it also has been emphasised that the willingness and ability of a mill to adopt the necessary environmental safeguards is important. There is evidence to suggest that the industry's willingness to cooperate varies among mills according to location. Unless those responsible for setting and enforcing standards are willing to use the regulative mechanisms at their disposal to encourage industry to cooperate, individual mills cannot be expected to voluntarily make large expenditures on environmental safeguards, which would put them at a disadvantage with other mills that choose not to make similar expenditures.

Federal environmental officials have not chosen to bring the total of the industry under the effluent regulations. In many cases, they have depended on the cooperation of the provinces to enforce standards at least as stringent as those specified in federal regulations. It appears that provincial environmental authorities are not always willing to enforce standards at least as stringent as those specified under federal regulations. The reasons for this are unclear, because some provinces have more rigid requirements for particular effluents, while other provinces have less rigid requirements for the same effluent. Nonetheless, it would appear that EP must be prepared to take a more active role in enforcing federal standards, if progress in future is to match past accomplishments.

One of the original objectives of the federal authorities when establishing the regulations was to prevent pollution havens. This continues to be a worthwhile objective for protecting the right of all provinces to share equally in the opportunity to provide employment and generate income. It continues to be a desirable objective for ensuring that all Canadians live in an environment at least as good as their fellow citizens. It is an objective which helps ensure that one segment of industry does not have a competitive advantage over other elements within the industry because of government regulation. The administrative framework that has been established in cooperation with the provinces has helped to safeguard Canadians from economic and social inequities, which could result from the existence of pollution havens. This is particularly important in an industry which is of such overwhelming national importance as pulp and paper manufacturing. Regardless of the loadings reductions achieved by mills in Canada, if the majority of mills in Canada continually outperform mills in one or two locations over a long enough period of time, pollution havens will result. There continues to be a need for Federal Government participation in helping to control the effluent discharges caused by the pulp and paper industry in Canada.

All of industry should be brought under federal effluent abatement regulations, so that the minimal standards specified in the regulations can be equitably enforced nation-wide. The inclusion of the total of the industry under the regulations would eliminate some of the advantages enjoyed by existing mills over mills built subsequent to 1971. It would eliminate some of the advantage that is enjoyed by those already active in the industry over those seeking entry. It would eliminate some of the legal and administrative complications (discussed in Chapter Three) that detract from the systematic approach envisioned when the regulations were established.

CHAPTER FIVE

THE USE AND APPLICATION OF FEDERAL PULP AND PAPER EFFLUENT ABATEMENT REGULATIONS TO MEET EXISTING AND FUTURE CHALLENGES

In this Chapter the purpose is to examine the appropriateness of the regulative approach adopted by the Federal Government during the early 1970's for meeting the pollution problem challenges of the 1990's. A provincial and industry perspective on the federal role is presented, and examined in terms of the effluent reductions which can be expected, when using current federal administrative procedures and enforcement standards. The changing circumstances within the industry are reviewed in light of the trends in controlling pollution both nationally and internationally. The information and analysis undertaken in this Chapter are used as the basis for examining future alternatives of Environmental Protection in regulating effluent discharges from the pulp and paper industry. Since federal air emission guidelines are being used as originally intended, and air emissions from the industry have no apparent national implications at this time, they are not included as part of the assessment undertaken in the remainder of this report.

The Role of EP in Controlling the Waste Discharges from the Pulp and Paper Industry

Even though industry and provincial environmental officials generally support the continued participation of EP in controlling waste discharges from the pulp and paper industry, not everyone agrees on the federal role. Some provincial environmental authorities maintain that the EP role is to support the efforts of the provincial governments. Some industry spokespersons expressed the opinion that federal participation is not necessary, as they prefer to deal with provincial officials. Industry organisations sometimes argue that EP should allow the provinces to assume total responsibility for regulating the industry. However, as revealed by the survey information gathered in preparing this report, these opinions are not representative of the views of industry or provincial environmental authorities. Virtually every representative of both industry and provincial environmental agencies want continued EP participation. While there may be some disagreement over what role EP should perform, the consensus opinion of the total of those speaking on behalf of companies or agencies describe a role which is consistent with what was defined during the period when the federal effluent regulations were formulated. These views and opinions are not inconsistent with what can be perceived as federal jurisdictional responsibilities.

The role of EP as described by the majority opinion of provincial environmental officials and industry representatives is to:

(1) establish regulations and set minimum standards to be applied nationally;

(2) enforce federal regulations either through the provinces, or as appropriate, directly with company officials at the mill level;

(3) conduct environmental impact analyses mainly with the provinces, but also separately if necessary to provide

an independent perspective;

(4) establish toxicity regulations that can be applied as a standard for the industry;

(5) coordinate the environmental activities of the Federal Government by dealing with industry on behalf of all other federal agencies which have environmental responsibilities;

(6) undertake research and development on pollution control technologies, and assume responsibility for technology transfer between and among the provinces and internationally;

(7) maintain a regulatory atmosphere that is conducive to sound business practices, by providing economic intelligence and monitoring trends in pollution control technology nationally and internationally;

(8) provide public information and financial assistance to industry.

With the exception of enforcement at the mill level, the representatives of industry and provincial environmental agency officials almost totally supported EP participation in all of the foregoing activities. Industry representatives in British Columbia and Quebec did not feel that federal agencies should enforce regulations at the mill level. Representatives of environmental agencies in two provinces, which together only have a very limited number of mills, opposed federal enforcement of any industry regulations.

The role of EP, as reflected in the opinions of provincial environmental agency officials and spokespersons from industry, relate mainly to two very distinct responsibilities. The first is to help maintain uniform minimum standards which can be applied nation-wide. The second is to undertake those activities which are deemed necessary and appropriate to what are generally conceded as federal international obligations (i.e. intelligence gathering and applying standards that are in keeping with the environmental requirements of other nations with whom Canada competes internationally). Although not specifically referred to by spokespersons from industry, and only obliquely mentioned by provincial officials, a third obligation of EP that emanates directly from Section 33 of the Fisheries Act is the protection of fish and fish habitat. In what follows, the ability of EP to use existing standards and administrative procedures to fulfil these three obligations is examined.

The Use of Federal Standards as Minimum Industry Requirements

The overwhelming consensus among provincial environmental authorities is that the provinces are responsible for enforcement. EP should only intervene when it is necessary to enforce "minimum" standards. Both industry and provincial environmental agency officials feel that it is EP's responsibility to set the appropriate nation-wide standard for acute toxicity, but they also are of the opinion that changes are needed. At least amongst provincial environmental officials, the major concern is that the federal standards be "minimal" requirements, which do not result in duplication or overlap. To a considerable degree, provincial support for EP efforts rests on whether or not the federal standards are in fact minimal requirements that can be enforced nation-wide.

In Chapter Four it was determined that for both TSS and BOD, the collective performance of industry in reducing its effluent discharges is approaching the level which is required for nation-wide compliance. In that same Chapter, it was shown that large segments of the industry are not in compliance with federal TSS and BOD standards. The generally good success in meeting what could be considered a national level of compliance for all of industry, together with the modest number of mills actually in compliance, indicates three things. First, it shows that some mills in Canada have reduced their total TSS and BOD discharges well below the limits specified in federal regulations. Second, it shows that there is a very large difference between those mills performing well environmentally, and those not meeting federal standards. Third, it indicates that the federal limits for TSS and BOD are minimal requirements, that many mills in Canada can meet without disruption to their ongoing operations. The TSS and BOD federal limits can be viewed as minimal technical standards, which do not necessarily ensure the long-term protection of fish habitat.

The federal toxicity standard has been described as a simple test, that has many good features.[1] It is a pass/fail test that requires local fish to be placed in a tank comprised of 65 percent effluent from a mill's outfall and 35 percent freshwater for 96 hours. If at least 80 percent of the fish survive, the effluent from the mill is considered non-toxic. If less than 80 percent of the fish survive, the effluent is considered toxic. Unlike the toxicity limits of the provinces, the federal limits require that the mixture used in the tank be "replaced continuously at a constant rate".[2] The flow-through requirements of the federal test makes this test a more restrictive limit than those used by the provinces.[3] Federal toxicity limits, as specified in the regulations, are not enforced among all mills in any province in Canada. In fact, the compliance information for toxicity used throughout this report are based on provincial tests, which mostly serve as only a rough indication of compliance with federal standards. If federal requirements were applied using a continuous flow test for all mills, it is likely that somewhat less than the number referred to here as complying would actually meet the federal standard. The continued use of the federal test, without provision for water usage reductions, might result in even fewer mills meeting the standard in future. The federal toxicity standard is not a minimum standard, because it is the most stringent standard requirement in Canada. But neither does this standard necessarily provide adequate protection for fish and the environment. The standard as specified in the regulations probably can be best described as the median lethal requirement, which can be used on a nation-wide basis to provide a minimal acceptable level of protection for the environment.

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[1] Norman Bonsor, Neil McCubbin and John B. Sprague, Stopping Water Pollution At Its Source: Kraft Mill Effluents in Ontario, Report prepared by Expert Committee on Kraft Mill Toxicity for the Technical Advisory Committee, Pulp and Paper Sector of MISA, Ontario Ministry of the Environment, Toronto, April 1988, p.7-130.

The Potential for Improved Environmental Performance in Using Current Federal Standards

An examination of the distribution of effluent loadings among mills in the industry confirms wide differences in environmental performance. Figure 5:1 is used to show the distribution of production, TSS, BOD, and acute toxicity loadings among mills in Canada. The percentage loadings are shown on the vertical axis, and the percentage of mills (approximate numbers) are shown on the horizontal axis. It can be seen from this information that fifteen percent, or eighteen mills, in Canada account for about 32 percent of the total average daily production of Canada's direct discharge mills. Fifteen percent, or eighteen mills, account for approximately 42 percent of TSS loadings, nearly 50 percent of BOD discharges, and roughly 57 percent of the average daily volume of the total toxic effluent released. At the other extreme, (the right side of the horizontal axis), it can be seen that 30 percent of the mills, or 36 mills which together represent ten percent of the production, account for a very minor amount of the total TSS loadings (about five percent). Thirty percent of the mills account for roughly two percent of BOD, and make no contribution to acute toxicity loadings. The distribution shown in the Figure cannot be used to identify the performance of mills among different effluent categories. For example, the highest loadings mill in one effluent category is not necessarily among the highest loadings mill in others. The highest production mills are not necessarily the largest loadings mills. The information presented in this Figure shows that a few mills account for a very high proportion of total effluent loadings.

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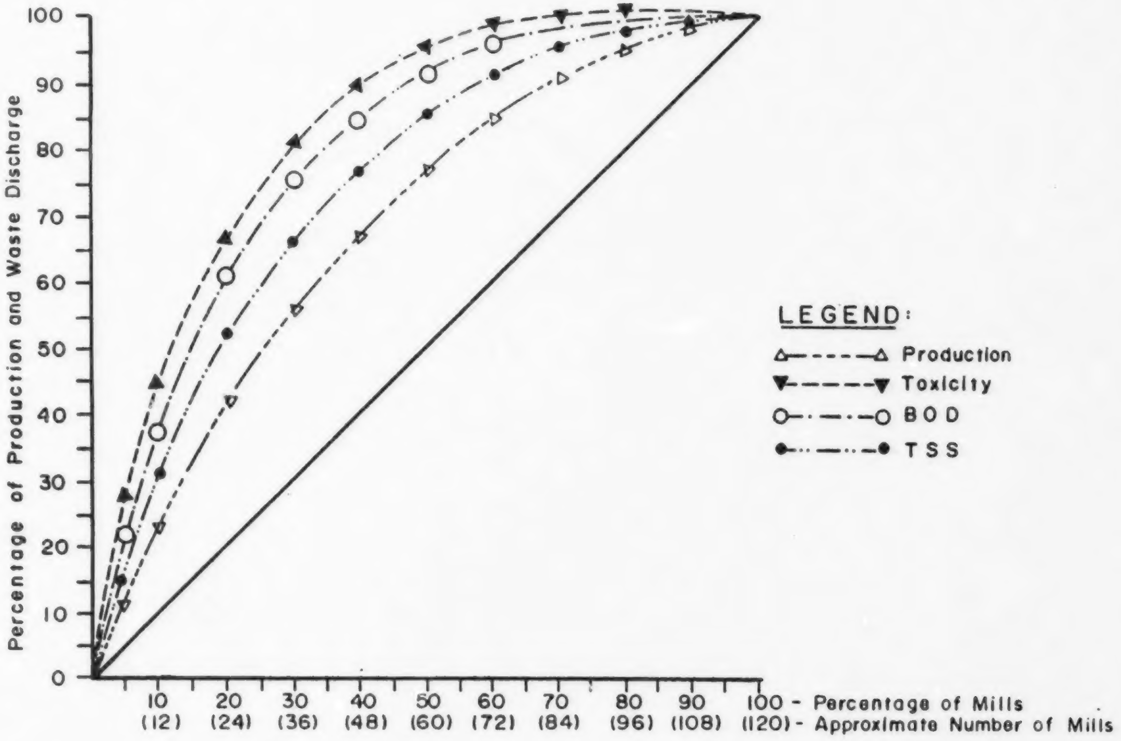
[2] Pulp and Paper Effluent Regulations, Environment Canada, Regulations, Codes and Protocols, Report EPS 1-WP-72-1, November 1971, p.6.

[3] Norman Bonsor, *et al.*, *op. cit.*, p.7-130 and 7-138.

A more detailed breakdown of the 30 highest loading mills for each effluent category is presented in Table 5:1. In this Table, a distinction is made among mills on the basis of the number of times the

FIGURE 5:1

AVERAGE DAILY PRODUCTION, TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND TOXICITY (TO FISH) LOADINGS[1] DISTRIBUTED ACCORDING TO PERCENTAGE AND (NUMBER) OF DIRECT DISCHARGE MILLS OPERATING IN 1985



[1] Based on actual discharge information from individual mills.

Source: Environment Canada, Ottawa.

TABLE 5:1

A COMPARATIVE BREAKDOWN OF THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE MILLS WITH THE HIGHEST LOADINGS FOR AT LEAST ONE EFFLUENT CATEGORY: TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND TOXICITY (TO FISH) - 1985

The thirty highest loadings mills in each effluent category total 52 (42%) of the total Direct Discharge Mills in Canada.

11 of the 52 (21%) are among the thirty highest direct discharge mills for all three loadings (TSS, BOD, Toxicity) categories.

14 of the 52 (26.9%) are amongst the thirty highest direct discharge mills in two of the three loading categories.

27 of the 52 (51.9%) are amongst the thirty highest direct discharge mills in one of the three loading categories.

The thirty highest discharge mills account for:

491 t/d or 59.7% of total TSS

1,413 t/d or 68.7% of total BOD loadings

4,125 m^3x10^3 or 71.1% of total toxicity loadings

29,247 t/d or 42.2% of total daily production

Source: Environment Canada, Ottawa.

same mill is included among the 25 percent highest loading mills in each effluent category. It is indicated that 27 of the 52 mills in the highest 25 percentile category are among the highest discharge mills for only one effluent category. Fourteen of the 52 are among the 30 highest direct discharge mills in two of the three loadings categories. Eleven of the 52 are among the 30 highest direct discharge mills for all three loadings categories. The information presented in Figure 5:1 and Table 5:1, together, suggests that major reductions in loadings can be achieved by improving the performance of the highest loading mills within the industry to the average of the industry.

Tables 5:2(A) and (B) are used to provide a breakdown of the highest 25 percent, or 30 direct discharge mills according to major pulping process. The information in these Tables shows that half of the highest loading mills for BOD are sulphite mills. The highest loading sulphite mills account for a disproportionate (relative to production) amount of TSS loadings, but perform reasonably well for toxicity when compared to other mills shown in the Table. Kraft mills account for twelve of the 30 highest loading mills for TSS, and sixteen of the 30 (more than half) of the highest acute toxicity loadings mills. Total TSS loadings could be reduced substantially if the seven highest loadings sulphite mills were to reduce their TSS loadings to the average of the industry. BOD loadings could be sharply reduced if the fifteen sulphite mills included in the highest 25 percent loadings mills category were to reduce BOD loadings to the average of the industry.

Tables 5:3(A) and (B) are used to show production, TSS, BOD, and

TABLE 5:2(A)

THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE PULP AND PAPER MILLS WITH THE LARGEST DAILY LOADINGS FOR TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD) WITH THEIR TOTAL AVERAGE DAILY PRODUCTION ACCORDING TO MAIN PRODUCTION PROCESS[1] - 1985

	Top 25 Percent TSS Discharge						Top 25 Percent BOD Discharge					
	Mills		Production t/d		TSS t/d		Mills		Production t/d		BOD t/d	
	#	%	#	%	#	%	#	%	#	%	#	%
Sulphite	7	23.3	5,103	17.5	120	24.4	15	50.0	10,451	39.4	868	61.4
Sulphite/ New Processes	4	13.3	3,131	10.7	78	15.9	4	13.3	3,041	11.5	117	8.3
New Processes	7	23.2	7,613	26.0	95	19.4	2	6.7	2,112	8.0	89	6.3
Kraft (Sulphate)	12	40.0	13,400	45.8	198	40.3	8	26.7	10,589	40.0	297	21.0
Groundwood	0	0	0	0	0	0	0	0	0	0	0	0
Other Processes	0	0	0	0	0	0	1	3.3	306	1.2	42	3.0
TOTAL	30	100.0	29,247	100.0	491	100.0	30	100.0	26,499	100.0	1,413	100.0

[1] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

Source: Environment Canada, Ottawa.

TABLE 5:2(B)

THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE PULP AND
PAPER MILLS WITH THE LARGEST DAILY LOADINGS FOR TOXICITY[1]
(TO FISH) WITH THE TOTAL AVERAGE DAILY PRODUCTION
ACCORDING TO MAIN PRODUCTION PROCESS[2] - 1985

	Top 25 Percent Toxicity Discharge					
	Mills		Production t/d		Toxicity	
	#	%	#	%	(m^3x10^3)	%
Sulphite	8	26.7	6,272	22.6	1,011	24.5
Sulphite/ New Processes	1	3.3	711	2.6	100	2.4
New Processes	5	16.7	7,734	27.8	1,034	25.1
Kraft (Sulphate)	16	53.3	13,059	47.0	1,980	48.0
Groundwood	0	0	0	0	0	0
Other Processes	0	0	0	0	0	0
TOTAL	30	100.0	27,787	100.0	4,125	100.0

[1] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours). If a mill had more than one test during the most recent test year, then the proportion of the tests that failed to total number of tests taken are used to determine volume of toxic discharge.

[2] "Sulphite" mills are defined as any mill using a sulphite process. "New Processes" include any mills producing thermo mechanical pulp (TMP), chemical thermo mechanical pulp (CTMP), sulphonated chemical mechanical pulp (SCMP), refiner mechanical pulp (RMP), and the Ontario Paper Corporation process ("OPCO"). "Other Processes" includes recycled paper or purchased pulp and neutral sulphite semichemical pulp using non-sulphur process.

Source: Environment Canada, Ottawa.

TABLE 5:3(A)

THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE PULP AND PAPER MILLS WITH THE LARGEST DAILY LOADINGS FOR TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD) WITH THEIR TOTAL AVERAGE DAILY PRODUCTION ACCORDING TO REGION - 1985

	Top 25 Percent TSS Discharge						Top 25 Percent BOD Discharge					
	Mills		Production t/d		TSS t/d		Mills		Production t/d		BOD t/d	
	#	%	#	%	#	%	#	%	#	%	#	%
British Columbia	10	33.3	12,523	42.8	180	36.7	5	16.7	6,471	24.4	205	14.5
Prairies	0	0	0	0	0	0	1	3.3	509	1.9	40	2.8
Ontario	2	6.7	2,819	9.6	22	4.5	5	16.7	5,175	19.5	197	13.9
Quebec	13	43.3	9,967	34.1	197	40.1	15	50.0	11,669	44.0	820	58.0
Atlantic	5	16.7	3,938	13.4	92	18.7	4	13.3	2,675	10.1	151	10.7
TOTAL	30	100.0	29,247	100.0	491	100.0	30	100.0	26,499	100.0	1,413	100.0

Source: Environment Canada, Ottawa.

TABLE 5:3(B)

THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE PULP AND PAPER MILLS WITH THE LARGEST DAILY LOADINGS FOR TOXICITY[1] (TO FISH) WITH THE TOTAL AVERAGE DAILY PRODUCTION ACCORDING TO REGION - 1985

	Top 25 Percent Toxicity Discharge					
	Mills		Production t/d		Toxicity	
	#	%	#	%	(m^3x10^3)	%
British Columbia	12	40.0	12,066	43.4	1,705	41.3
Prairies	1	3.3	513	1.9	98	2.4
Ontario	4	13.3	4,013	14.4	485	11.8
Quebec	10	33.3	8,925	32.1	1,576	38.2
Atlantic	3	10.0	2,270	8.2	261	6.3
TOTAL	30	100.0	27,787	100.0	4,125	100.0

[1] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours). If a mill had more than one test during the most recent test year, then the proportion of the tests that failed to total number of tests taken are used to determine volume of toxic discharge.

[2] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has an LC50 = 80, another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have an LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa.

acute toxicity loadings for the 25 percent highest loadings mills in Canada. The information in these Tables shows the comparatively high loadings levels of Quebec mills. Mills in British Columbia and Quebec, together, account for 23 of the 30 highest TSS loading mills, twenty of the 30 highest BOD loadings mills, and 22 of the 30 highest acute toxicity effluent discharge mills. Quebec and British Columbia mills do not compare favourably with Ontario mills, where only a small number of that province's 28 direct discharge mills are among the 25 percent best loadings categories.

Table 5:4 is used to show the number and percentage of the highest 25 percent loading mills in compliance with both federal and provincial effluent standards according to region. Compliance with federal toxicity requirements is compared with the number of mills having secondary treatment. When it is recognised that British Columbia provincial standards are used by federal officials as the criteria against which compliance with federal standards are determined, it becomes apparent that very major reductions in TSS and toxicity loadings could be achieved in British Columbia if federal standards were being met. One of the thirty highest acute toxicity loadings mills is in compliance; four have secondary treatment systems. Toxicity loadings in Quebec could be substantially reduced if federal toxicity limits were being met. The loadings in every region could be reduced as a result of the nation-wide application of federal standards.

The eleven highest loading mills for all three categories are

TABLE 5:4

THE THIRTY (TWENTY FIVE PERCENT) DIRECT DISCHARGE PULP AND PAPER MILLS WITH THE LARGEST LOADINGS FOR TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), ACCORDING TO COMPLIANCE[1] WITH FEDERAL EFFLUENT REGULATIONS AND PROVINCIAL REQUIREMENTS, TOXICITY[2] (TO FISH) COMPLIANCE IS COMPARED WITH NUMBER OF MILLS WITH SECONDARY TREATMENT ACCORDING TO PROVINCE - 1985

	Top 25 Percent TSS Discharge	In Compliance				Top 25 Percent BOD Discharge	In Compliance				Top 25 Percent Toxicity Discharge	In Compliance and with Secondary Treatment			
	Mills	Federal		Provincial		Mills	Federal		Provincial		Mills	Federal		Secondary Treatment	
	#	#	%	#	%	#	#	%	#	%	#	#	%	#	%
British Columbia[3]	10	3	30.0	8	80.0	5	5	100.0	5	100.0	12	1	8.3	3	25.0
Prairies	0	0	0	0	0	1	0	0	0	0	1	0	0	1	100.0
Ontario	2	2	100.0	2	100.0	5	2	40.0	4	80.0	4	0	0	0	0
Quebec	13	5	38.5	1	38.5	15	2	13.3	0	0	10	0	0	0	0
Atlantic	5	1	20.0	1	20.0	4	2	50.0	2	50.0	3	0	0	0	0
TOTAL	30	11	36.7	12	40.0	30	11	36.7	11	36.7	30	1	3.3	4	13.3

[1] Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be an considered a violation under the law.

[2] The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

[3] Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has a LC50 = 80, and another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Regional Personnel of the Department of Environment and Provincial Environmental Authorities.

identified in Table 5:5. It is shown that five of the eleven highest loading mills in Canada are located in Quebec. Three are located in British Columbia, two are located in the Atlantic, and one is located in Ontario. Six of the eleven mills produce sulphite pulp, four produce kraft pulp, and five produce TMP and SCMP. The total production of the eleven mills represents just under twenty percent of the total production from all of Canada's direct discharge mills. They account for 28 percent of the TSS loadings, 28 percent of the BOD loadings, and slightly over 31 percent of acute toxicity volumes.

Table 5:6 is used to show the loading reductions that could be achieved if the eleven highest loading mills in Canada were required to meet the 1985 median loadings levels of all direct discharge mills in the industry. If the eleven highest loading mills in Canada achieved the median level of discharge of all mills within the industry, TSS loadings would be decreased by 21 percent, BOD would be decreased by almost 24 percent, and acute toxicity loadings would decline by 22 percent. The declines that could be achieved as a result of the eleven highest loading mills in Canada meeting the median loadings level of the industry, would be four percent of the TSS loadings that have been achieved since 1971, seven percent of the BOD loadings that have been achieved since that time, and roughly 43 percent of the total toxicity reductions achieved during the past sixteen years.

Compliance with federal requirements is shown for the eleven largest loading mills during 1985 is shown in Table 5:7. According to the

TABLE 5:5

TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), TOXICITY (TO FISH) AND PRODUCTION OF ELEVEN (TEN PERCENT) HIGHEST RATED EFFLUENT DISCHARGE MILLS IN CANADA BY PROVINCE AND MAIN PROCESS CATEGORIES COMPARED WITH TOTAL LOADINGS OF ALL DIRECT DISCHARGE MILLS IN CANADA - 1985

	Process	TSS (Kg/d)	BOD (Kg/d)	Toxicity (m3x103)	Production (t/d)
British Columbia					
MacMillan Bloedel (Powell River)	Kraft/TMP	19,859	30,462	259	1,683
Crown Forest Products (Elk Falls)	Kraft/TMP	26,547	42,163	202	1,952
B.C. Forest Products (Crofton)	Kraft/TMP	17,605	45,811	125	1,893
Ontario					
Great Lakes Forest Products (Thunder Bay)	Sulphite/ Kraft	13,235	46,323	217	2,068
Quebec					
Tembec Inc. (Temiscaming)	Sulphite	46,985	157,358	268	404
CIP Inc. (Latuque)	Kraft	12,366	39,846	228	1,374
CIP Inc. (Gatineau)	SCMP	17,484	48,227	146	1,457
Consolidated Bathurst Inc. (Shawinigan)	Sulphite	12,397	63,354	89	805
La Campagnie Gaspesia Inc. (Chandler)	Sulphite	9,654	31,589	73	611
Atlantic					
Corner Brock Pulp & Paper Inc. (Corner Brock)	Sulphite/ TMP	42,887	28,880	100	722
Stora Forest Industries (Point Tupper)	Sulphite	12,761	52,352	84	818
TOTAL		231,780	586,365	1,791	13,787
Total Discharges for TSS, BOD, Toxicity, and Production for Canada in t/d and (m^3x10^3)		823	2,056	5,801	69,139
Total Discharge for TSS, BOD, Toxicity and Production for 11 mills with Highest Effluent Discharge in t/d and (m^3x10^3)		232	586	1,791	13,787
Mills with Highest Discharge as % of Total for Canada		28.2%	28.5%	30.9%	19.9%

Source: Environment Canada, Ottawa.

TABLE 5:6

THE PERCENTAGE REDUCTION IN TOTAL DAILY LOADINGS THAT COULD BE ACHIEVED IF THE ELEVEN (TEN PERCENT) HIGHEST RATED EFFLUENT DISCHARGE MILLS WERE TO ACHIEVE THE MEDIAN LEVEL OF EFFLUENT LOADINGS OF ALL DIRECT DISCHARGE MILLS IN CANADA - 1985

	TSS (t/d)	BOD (t/d)	Toxicity (M^3x10^3)
(1) Total and (median) loadings of all direct discharge mills in Canada	823 (5)	2,056 (9)	5,801 (45)
(2) Total loadings of eleven highest discharge mills	232	586	1,791
(3) Total loadings of eleven highest mills if they reduced effluent to median of all direct discharge mills in Canada (median x mills)	55	99	495
(4) Total waste loadings reduction of the eleven mills achieved median discharge of all direct discharge mills in Canada (2) minus (3)	176	487	1,296
(5) The % reduction in total loadings achieved if eleven mills reduce effluent to median of all direct discharge mills in Canada (4) as % of (1)	21.3%	23.7%	22.3%

1 Comparisons are based on median discharge of those causing loadings during 1985, because average loadings would be distorted by the different volumes associated with different processes, variations in the number of days of operation during 1985, and the impractical realities of the highest volume discharge mills actually achieving the average loadings of the industry.

Source: Environment Canada, Ottawa.

TABLE 5:7

THE ELEVEN (TEN PERCENT) HIGHEST DISCHARGE MILLS IN CANADA ACCORDING TO WHETHER CONSIDERED IN COMPLIANCE WITH FEDERAL REGULATIONS[3] FOR TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD), AND TOXICITY[4] (TO FISH) - 1985

	TSS	BOD	Toxicity
British Columbia[5]			
MacMillan Bloedel (Powell River)	Pass	Pass	3/4[2]
Crown Forest Products (Elk Falls)	Fail (M)[1]	Pass	1/5
B.C. Forest Products (Crofton)	Fail (M)	Pass	1/3
Ontario			
Great Lakes Forest Prod. (Thunder Bay)	Pass	Pass	1/2
Quebec			
Tembec Inc. (Temiscaming)	Fail	Fail	Fail
CIP Inc. (La tuque)	Pass	Pass	Fail
CIP Inc. (Gatineau)	Fail (M)	Fail	Fail
Consolidated Bathurst Inc. (Shawinigan)	Pass	Fail	Fail
La Campagnie Gaspesia Inc. (Chandler)	Fail	Fail	Fail
Atlantic			
Corner Brook Pulp & Paper Inc. (Corner Brook)	Fail	Fail (M)	Fail
Stora Forest Industries (Point Tupper)	Pass	Pass	Fail

1 (M) after fail indicates only marginally out of compliance

2 Rates of 1/2, 1/5, etc., indicates portion of total tests that pass

3 Compliance as indicated in this table does not necessarily mean that a mill is in legal compliance under federal effluent regulations, just as non-compliance does not necessarily mean a mill is not in legal compliance under the regulations. Non-compliance suggests that a mill operated in excess of federal standards sometime during the year in which the information was gathered, but there are any of a number of reasons why this might not be considered a violation under the law.

4 The accuracy of toxicity data depends on the volume of water passing through the mill and the number of tests taken during the most recent year in which test results are available for 1985. The number of tests taken and the regularity of the tests varies greatly among the provinces. In the information presented on toxicity it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in a 100 percent effluent after 96 hours) is equal to LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours).

5 Toxicity requirements in British Columbia are based on provincial criteria. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has a LC50 = 80, and another has a LC50 = 34, and still another has a LC50 = 13. All interior mills have a LC50 = 90 requirement except one which has a LC50 = 10.

Source: Environment Canada, Ottawa. Information gathered in cooperation with regional environmental authorities and provinces.

information in this Table, five of eleven mills are considered in compliance with federal TSS standards, six of eleven are considered in compliance with federal BOD standards, and one is in compliance for acute toxicity. Another three were in compliance for acute toxicity one out of five times tested, one was in compliance one-third of the time, and another was in compliance 50 percent of the time. Once again, it should be noted that British Columbia mills are considered in compliance with federal standards when they meet provincial standards. The information contained in this Table appears to confirm that the minimal standards specified in the federal effluent abatement regulations could be used to make loadings reductions in every region in Canada. If the eleven largest loadings mills in Canada were required to meet federal standards, variations between and among mills located in different regions could be substantially reduced.

The information presented in this section indicates that the use of provincial compliance standards as a substitute for determining compliance with federal standards is inappropriate. Even mills discharging large amounts of effluents are not likely to achieve compliance with minimal federal standards, if provincial standards are used as a substitute for federal limits. Major effluent reductions can be achieved from mills in all regions, when federal standards are enforced. Federal standards, as currently specified, can be used to reduce the amount of variation between and among mills located in different regions.

The Use of Minimum Federal Standards to Protect the Environment

There is little doubt that when existing standards are enforced uniformly across regions, that major loadings reductions can be achieved. However, the standards as currently specified do not necessarily insure the protection of fish and fish habitat, and might be overly restrictive for mills using some processes when taking into account local environmental circumstances.[4] This is of concern to both those who administer federal regulations and to a very large number of industry representatives. The concern among industry officials is reflected in the information presented in Table 5:8, which shows that 98 percent of industry want assimilative capacity to be taken into account in the regulations.[5] Ninety-six percent of industry want amendments to toxicity standards. A minimum of 30 percent want greater research, more emphasis on economics, and more uniform enforcement of the regulations. As shown in Table 5:9, the consensus among industry officials (66 percent) is that federal regulations impede long-term planning within the industry.

At least on surface, these views appear somewhat contradictory. The obvious reason for this is that the use of assimilative capacity to determine the discharge levels is not necessarily conducive to the uniform enforcement of regulations nation-wide. However, the uniform and equit-

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[4] This was understood by those who originally set federal standards and administrative procedures. As noted in Chapter Three, there was to be a regular review of the standards. See the discussion on p.230 of Chapter Three.

[5] Assimilative capacity is subject to a number of different interpretations. There are those who believe that the assimilative capacity of a receiving environment depends on the amount of dilution that takes place. In other words, when environmental degradation cannot be measured, it is assumed that no impact is taking place. There are others who believe that the introduction of any substance into the environment which results in changes to the ecosystem is not biologically assimilative. Since all human activities cause changes to the ecosystem, and not all changes are necessarily undesirable, this interpretation has to be considered overly restrictive. The interpretation of assimilative capacity used in this report is the amount of effluent, that can be discharged into the receiving environment without causing detectable or scientifically predictable degradation to the environment or a threat to life.

TABLE 5:8

PULP AND PAPER MILL AND INDUSTRY REPRESENTATIVES VIEWS ON WHERE FEDERAL ENVIRONMENTAL PROTECTION SHOULD MAKE A GREATER EFFORT IN HELPING THE INDUSTRY TO PROTECT THE ENVIRONMENT AS A PERCENTAGE OF THE TOTAL INDUSTRY INCLUDED IN THE SURVEY ACCORDING TO REGION - 1987

	British Columbia %	Ontario %	Quebec %	Atlantic/ Prairies %	Canada %
Assimilative Capacity Should be Taken Into Account in the Regulations	100.0	100.0	100.0	90.0	98.0
Amend Toxicity Standards and Measurements	100.0	100.0	100.0	80.0	96.0
Greater Research and Dissemination of Information	54.6	33.3	23.6	50.0	38.0
More Emphasis on Understanding Economics of Mills and Industry	45.5	8.3	58.8	20.0	34.0
Greater Consistency in Enforcement Nation-wide	27.3	41.7	17.6	40.0	30.0
More Effort on Maintaining Contact with Industry (not just when things go wrong)	66.7	8.3	0	20.0	18.0
Better Industry Training of EP Personnel	0	8.3	5.9	10.0	6.0
Bring All Mills Under Regulations	9.1	0	0	10.0	4.0
Less Interference in Industry Operations	0	8.3	0	0	2.0

Source: Industry and Provincial Agency Survey, 1987.

TABLE 5:9

PULP AND PAPER MILL AND INDUSTRY VIEWS[1] AS TO WHETHER OR NOT FEDERAL PULP AND PAPER REGULATIONS (OR GUIDELINES) IMPEDE OR CONTRIBUTE TO ORGANISED LONG-TERM PLANNING WITHIN THE INDUSTRY - 1987

	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada	
	#	%	#	%	#	%	#	%	#	%
Impedes Organised Planning Within The Industry	7	53.9	11	91.7	17	56.7	8	80.0	43	66.2
Contributes to Organised Planning Within Industry	2	15.4	0	0	12	40.0	1	10.0	15	23.1
No Opinion	4	30.8	1	8.3	1	3.3	1	10.0	7	10.7
	13	100.0	12	100.0	30	100.0	10	100.0	65	100.0

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[1] Individual respondents sometimes chose more than one opinion category.

Source: Industry and Provincial Agency Survey, 1987.

able enforcement of regulations does not necessarily require that the same discharge limits be enforced for every mill in Canada. More modestly, it requires that mills using the same processes and operating within the same environment be subject to the same restrictions as all other mills in similar circumstances. Even though some minimal limits are required to reduce total effluent loadings in order to protect the integrity of the environment nation-wide, there may be instances where local circumstances dictate a longer time frame to achieve loadings reductions of a particular effluent. There may be instances where more restrictive limits are necessary to protect fish and fish habitat.[6] The challenges that obviously arise from this are twofold. First, it must be determined when a mill should be given more time to reduce its effluent discharges. Second, some criteria have to be established for determining, when more restrictive loading limits are appropriate.

Mill operators do not want to adopt discharge control measures when enviromental results are uncertain, even when the costs of implementing such safeguards is within the financial capacity of the firm. However, they are particularly resentful of having to adopt controls, when the restrictions are of doubtful merit and the economic burden on the mill operation is substantial or even intolerable.

Those responsible for enforcing federal regulations, generally accept that provincial enviromental authorities in most provinces are responsible for tailoring the permitted discharge from mills to local environmental circumstances, but they also are aware that the provinces have different priorities for protecting fish than do federal officers with their specific obligations for fish protection. In some regions, EP personnel are continually being pushed by DFO staff to enforce the more general provisions of Section 33 of the Fisheries Act to protect certain runs of fish, while provincial authorities argue that more stringent requirements are not necessary. EP with its somewhat more comprehensive concern for the environment undoubtedly is the appropriate federal agency to arbitrate between the often uncompromising position of DFO with respect to fish and those who have a more broadly based mandate for protecting the whole of the environment. Nonetheless, there is a need for a clearly stated set of criteria against which an appropriate environmental position can be established, when taking into account the concerns of industry and those with specific resource responsibilities.

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[6] Once again, this is not inconsistent with what was anticipated by those responsible for setting the regulations in 1971. As noted in Chapter Three, the regulations were to be enforced with a regard for the processes being used and the economic circumstances of the individual mill.

Effluent Loadings and Environment Impact

The assumption implicit in technically based regulations is that the greater the production from a mill, the greater the effluent loadings generated. It also is implicitly assumed that the larger the level of loadings from a mill, the more environmentally disruptive the mill operation. The logic of this cannot be refuted. It is obvious that without industry there would be no effluent loadings from pulp and paper manufacturing (neither would the industry provide any jobs or income). If the effluent loadings from the industry were reduced to zero, there is high probability that there would be a vast improvement in the nation's water quality and environment. Government must work with industry to reduce effluent loadings for all mills in the industry. However, this does not necessarily mean that all mills with high production levels generate large effluent discharges. It does not necessarily mean that mills with large discharges are more environmentally disruptive than mills with low levels of discharge. The prima facie evidence for these observations is that low level production sulphite mills account for a disproportionately large amount of the industry's total effluent waste, and some locations are more sensitive to the introduction of waste material than others. Nonetheless, somewhat more tangible evidence can be developed, when comparisons of changes in production and loadings are examined against defined areas of environmental impact.

Figures 5:2(A) and (B) and 5:3 are used to provide a comparison between 1978 and 1985 for average daily production and average daily TSS, BOD, and acute toxicity loadings for ten coastal mills in British Columbia. Figure 5:2(A) shows the percentage increases and decreases in production, TSS, and BOD for ten mills which are identified on the Figure by an assigned number.[7] Figure 5:2(B) shows the percentage change between 1978 and 1985 for production and acute toxicity. Once again, the mills are identified by the same identity number. According to the information in these Figures, TSS, BOD, and acute toxicity loadings do not change in direct relationship with changes in production. The production

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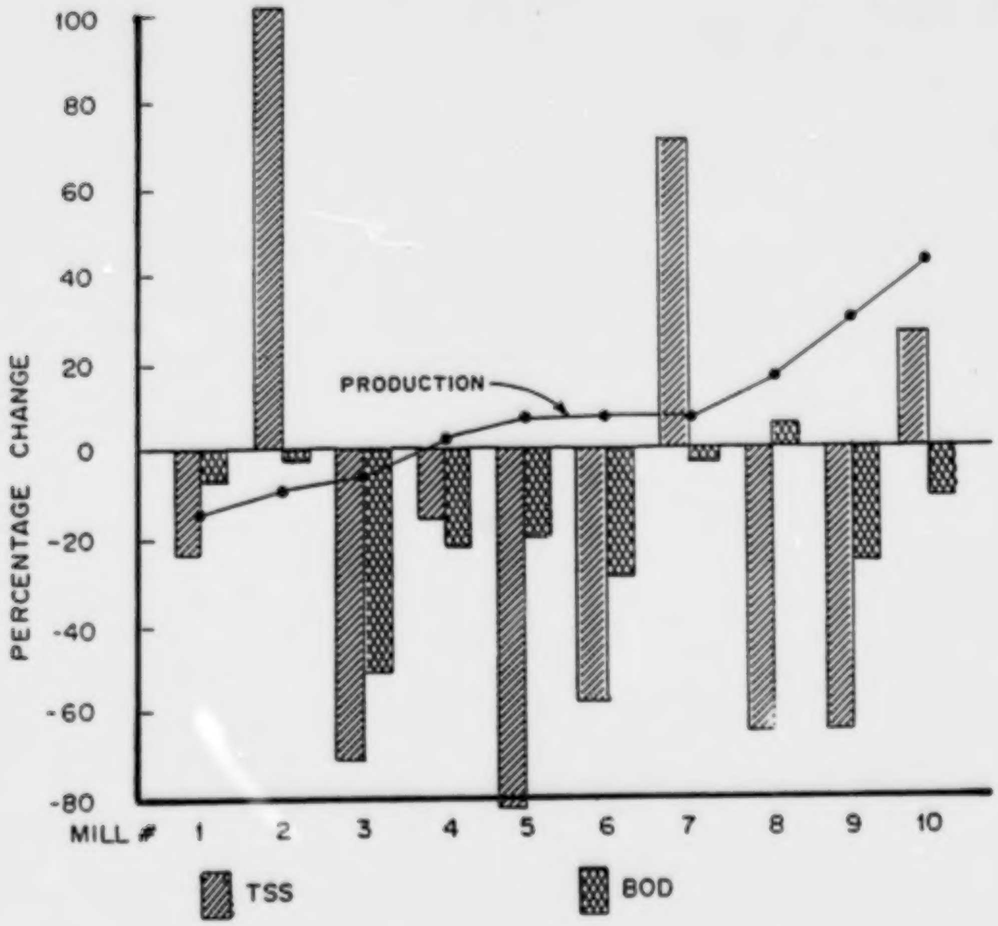
[7] The ten coastal mills used in the comparisons provided in Figures 5:2(A) and (B), 5:3, and 5:4 include the same mills identified earlier in Chapter Four (see Tables 4:14 and 4:15). These mills are used, because information is available as a result of work undertaken by Alan Colodey of the Marine Program Section in the Pacific and Yukon Region. The use of these mills for examining relationships among production, loadings, and zones of impact is considered appropriate because of direct federal responsibility for protecting the large salmonid populations located in the coastal waters of British Columbia.

FIGURE 5:2(A)

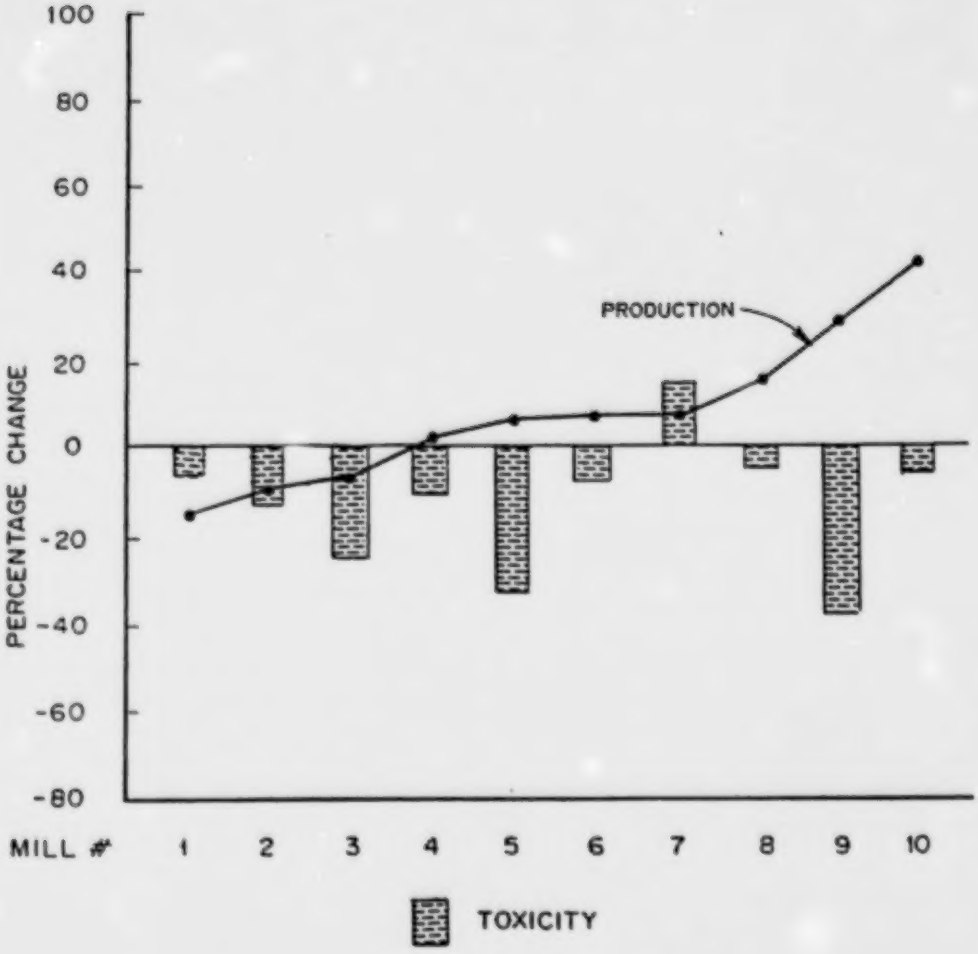
PERCENTAGE CHANGE BETWEEN 1978 AND 1985 FOR AVERAGE DAILY PRODUCTION (t/d) AND AVERAGE DAILY TOTAL SUSPENDED SOLIDS AND BIOCHEMICAL OXYGEN DEMAND (t/d) FOR TEN MARINE MILLS IN BRITISH COLUMBIA



Source: Marine Program Section, EP, Pacific and Yukon Region.

FIGURE 5:2(B)

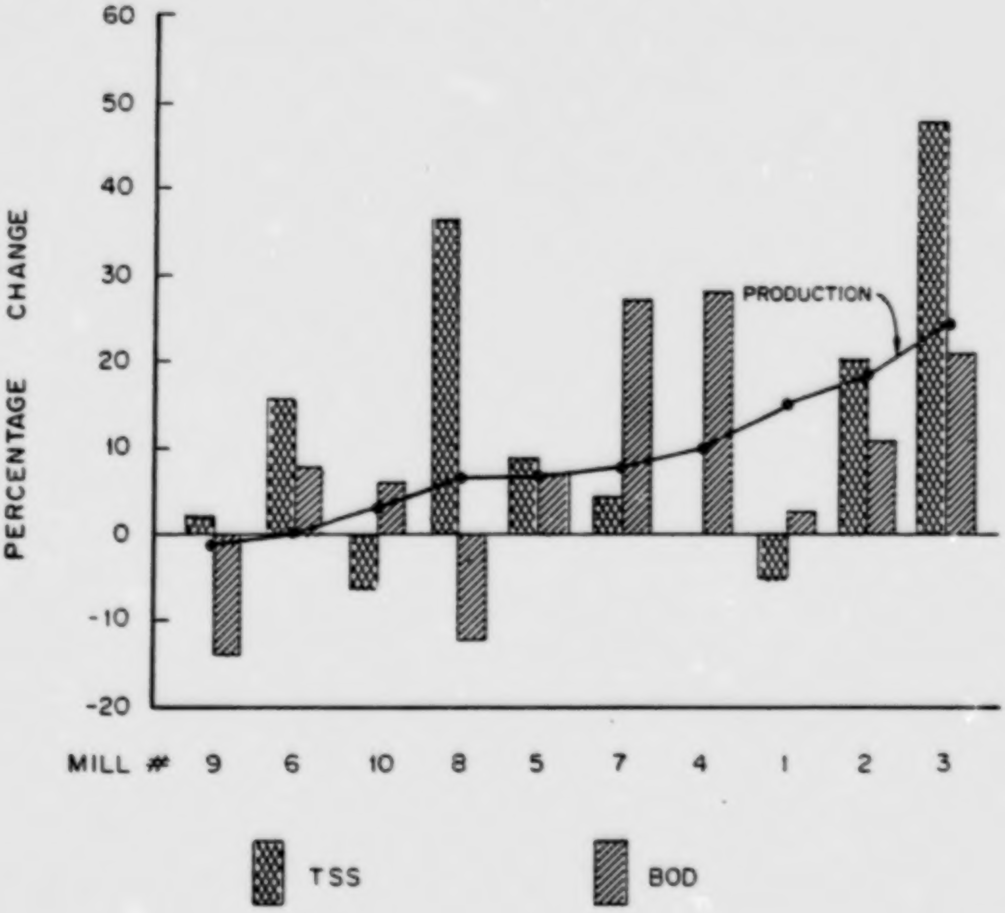
PERCENTAGE CHANGE BETWEEN 1978 AND 1985 FOR AVERAGE DAILY PRODUCTION (t/d) AND TOXICITY TO FISH LOADINGS (m3/d) FOR TEN MARINE MILLS IN BRITISH COLUMBIA



Source: Marine Program Section, EP, Pacific and Yukon Region.

FIGURE 5:3

PERCENTAGE CHANGE BETWEEN 1986 AND 1987 FOR AVERAGE DAILY PRODUCTION (t/d) AND TOTAL SUSPENDED SOLIDS AND BIOCHEMICAL OXYGEN DEMAND (t/d) FOR TEN MARINE MILLS IN BRITISH COLUMBIA



Source: Marine Program Section, EP, Pacific and Yukon Region.

of mill 2 decreased by about ten percent between the two discrete years 1978 and 1985, while TSS loadings increased by 97 percent, BOD releases declined by roughly two percent, and acute toxicity fell by very nearly fourteen percent. Mill 10 increased production by over 40 percent and TSS loadings by roughly 30 percent, but BOD discharge went down by about twelve percent and acute toxicity releases were reduced by seven percent. Effluent loadings from British Columbia coastal mills do not vary either directionally or proportionally with changes in production for the years shown in these Figures.

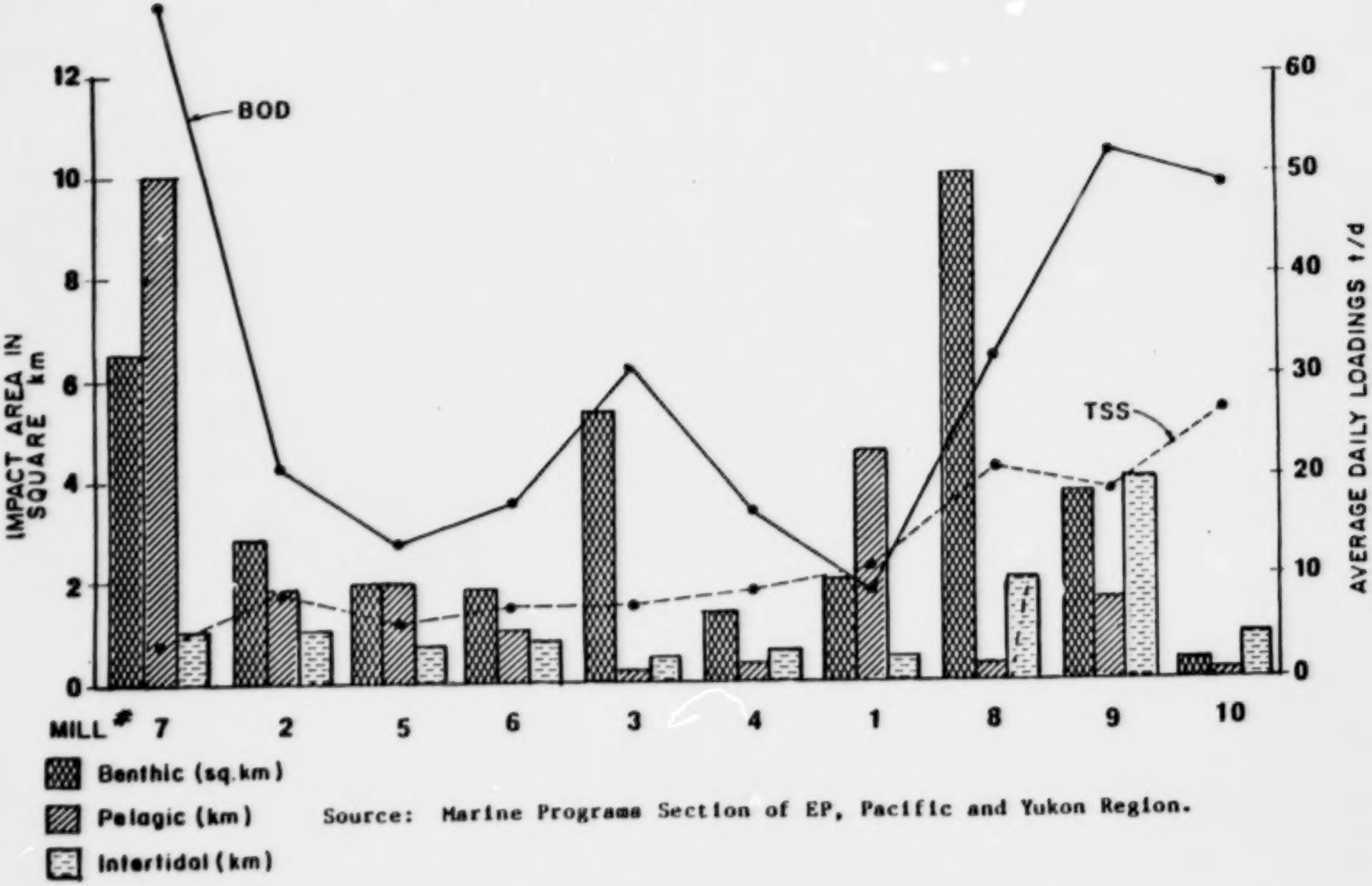
The information presented in Figure 5:3 shows the percentage changes in average daily production and changes in TSS and BOD loadings between 1986 and 1987 for the same ten coastal mills, which are labelled using the identity numbers previously recorded in Figures 5:2(A) and (B). The information in this Figure indicates that for some mills changes in loadings between one year and the next appear to vary consistently with changes in production. The TSS and BOD loadings for mill 5 changed by about the same percentage as did the change in production. TSS and BOD loadings from mills 9 and 10 also changed in the same direction and somewhat proportionally with changes in production. In fact the divergence between production and loadings do not appear to be as pronounced in Figure 5:3 as was the case in Figures 5:2(A) and (B).

When the control measures used at particular mills are compared with the loadings and production information provided in Figures 5:2(A) and (B), it would appear that the environmental efforts that take place within a mill have a substantial influence on the loadings perfomance of an individual facility over the longer term. On the basis of Figure 5:3, it would appear that changes in loadings do vary somewhat more consistently with changes in production in some cases, but not in any apparent pattern. It is generally acknowledged that the immediate or short-term result of increases in production may be an increase in loadings, which exceed the effluent treatment capacity of a mill. However, this does not explain why major increases in production of the same product result in proportional decreases in loadings between one year and the next without the use of additional control equipment (i.e. mills 5, 6, 9, and to a lesser extent 8). It may be that production increases which approach a mill's capacity improves overall efficiency, and in turn results in reduced loadings. If this is true, then it can be said that an efficiently operated kraft mill is cleaner environmentally than one that is not efficient. This is an observation which supports continued emphasis on the use of internal controls.

Cross-sectional information on TSS and BOD loadings and size of impact area are shown in Figure 5:4 for the same marine mills using the same mill identity numbers. The zones of impact are categorised as benthic (seabed), pelagic (surface water column), and intertidal (area between high and low tide). The TSS and BOD loadings for each mill are approximately depicted as continuums between discrete points for the purpose of illustration, but have no significance. The information shown in this Figure appears to suggest a loose but inconsistent relationship between loadings and impact. The obvious exception is mill 10 with very

FIGURE 5:4

RELATIONSHIP BETWEEN TOTAL SUSPENDED SOLIDS (TSS), BIOCHEMICAL OXYGEN DEMAND (BOD) LOADINGS AND BENTHIC, PELAGIC AND INTERTIDAL ZONE OF IMPACT FOR TEN MARINE MILLS IN BRITISH COLUMBIA - 1986



Source: Marine Programs Section of EP, Pacific and Yukon Region.

large loadings, the measurable area of impact of this mill is small for all three impact zone categories. However, it is apparent that the type of effluent discharge does not influence the difference zone categories in any consistent pattern. It also is apparent that area of measurable impact does not vary with the amount of TSS and BOD loadings from the ten coastal mills in British Columbia. On the basis of the very limited and subjective analysis undertaken here, it can be concluded that the highest loadings mills are not necessarily the most disruptive to the environment.[8] Mill location has a very substantial bearing on the measurable impact that effluents have on the receiving environment.

The technically based standards adopted in 1971 were appropriately used for establishing the first nation-wide limits for effluent discharge. They remain appropriate for ensuring a reasonably uniform pattern of effluent reduction throughout the whole of the industry. The exclusive use of technically based standards would continue to be appropriate, if all waste substances dumped into Canada's waters by the industry could be eliminated over time. The exclusive use of technical standards might even be appropriate if all mills could achieve the same loadings levels with equal ease at a particular point in time, and if environmental impact from mill operations in each location was approximately the same. Large production mills are not necessarily the highest loadings mills. Loadings levels do not necessarily determine the degree to which a mill operation impacts on the environment. Under such circumstances, it would seem reasonable to allow certain mill operations more time to meet federal standards, when circumstances dictate. It would seem reasonable to expect that some mill operations would be required to meet more stringent effluent discharge levels, when it is clear that minimum standards do not provide adequate protection for fish and fish habitat. Troublesome and imperfect though it may be, the only way to determine whether exceptions to specified standards are environmentally acceptable is through the use of biological impact assessment.

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[8] The examination used here is referred to as limited, because only ten mills located next to the marine waters of British Columbia are used in the assessment. It is subjective because environmental impact is measured on the basis of affected area using three parameters, which are not considered the most appropriate for assessing impact on a marine environment. Nonetheless, there is considerable intuitive appeal in believing that volume of waste discharge influences the amount of area affected by a processing operation. At least for the ten marine mills in British Columbia, this is not a valid premise.

A considerable amount of the dissatisfaction expressed by industry about unfair enforcement of regulations results from the view that the regulations are being enforced arbitrarily. Exceptions to the standards specified under the regulations should be validated and negotiated on the basis of the evidence gathered through biological impact assessment and not on the basis of unsubstantiated professional judgement. No matter how knowledgeable and experienced those making the decision, decisions to enforce more restrictive limits or to allow greater time to achieve standards appear arbitrary unless supported by tangible biological evidence.[9] This is not an argument which supports the wholesale use of biological assessment under all circumstances. It would seem reasonable to expect that only a small portion of the mills operating in Canada would be regarded as exceptions either for reasons of locational environmental circumstances or economic hardship. It is an argument for the selective use of biological impact analysis to validate less stringent requirements at some mills when circumstances dictate. It is an argument for using more stringent limitations when there is a threat to human health or fish populations. Finally, it is a perspective which supports providing for the selective use of biological impact analysis for enforcing the effluent abatement regulations.

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[9] See discussion on pp.124 and 125 of Chapter Two.

The use of environmental impact analysis to set standards for individual mills has numerous advantages. First, over the longer term it would encourage new mills to locate in less environmentally sensitive areas. Second, it could be used to set criteria for dealing with those mills, which due to circumstances at the individual facility, are not operating in accordance with the limits specified in the regulations. Third, it would avoid some of the uncertainty associated with the ill-defined "best practicable technology".[10] Fourth, it would encourage better cooperation from industry. Fifth, it would lend further support to the basic principle that fairness does not necessarily depend on having the same discharge limits applied to all mills in Canada, but in requiring mills operating in the same environmental and technical circumstances to meet the same restrictions. Sixth, it would help focus attention on the main responsibility of protecting the environment.[11]

The Acute Toxicity Limits Specified Under Federal Regulations

The bioassay test specified under federal regulations (described above) is a good monitoring test, which when applied properly provides an indication of the deleterious effects of all the toxic substances released from a pulp and paper manufacturing operation. The test also gives a rough indication of the sublethal and chronic effects of mill waste.[12] It has a predictive value with respect to the ecological consequences of toxicity discharge.[13] The test does not provide any indication of the degree of toxicity in effluent below the specified survival rate,[14] and therefore cannot be used to distinguish the severity of the problem between and among mills.[15] However, the usefulness of this approach for controlling mill toxicity is supported by the fact, that since the test was first introduced in the regulation, many jurisdictions have adopted the use of the same test (not necessarily using the same effluent concentrations or fish survival criteria).

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[10] Some argue that BPT "is neither technically sound or biologically useful". Norman Bonsor, et al., op. cit., p.1-5. See discussion pp.207-208 of Chapter Three.

[11] In this regard it should be noted that there is inconsistency between the long-standing position of EP to avoid dictating the type of environmental safeguards a mill must adopt, and the emphasis placed on limiting mill effluent developed on the basis of what are considered the best technologies available.

Both the test, and the limits used in the test, are of concern to industry and government administrators, because of flaws which have become apparent with the passage of time. The many attempts that have been made to reach a consensus on the changes necessary, have not resulted in agreement. The reason for government dissatisfaction with the federal toxicity requirements, in large degree, can be explained by the apparently poor compliance performance of mills within the industry. As recorded earlier in Chapter Four, only 32 percent of the 122 direct discharge mills in the industry are considered in compliance with federal toxicity limits. When the federal standards are interpreted on the basis of the test requirements specified in the regulations, perhaps as few as 25 mills in Canada would continually meet federal standards.[16] Concern among government officials has caused some to advocate the across-the-board requirement for all mills to install biological secondary treatment. There is no question that biological secondary treatment does help reduce toxicity, but it does not always result in satisfactory control of acute toxicity.[17] It has been previously shown that only modest reductions in acute toxicity can be achieved by those performing well environmentally (Figure 5:1), and the imposed use of secondary treatment may cause unnecessary economic hardship for some small, low production operations.[18] The solution to poor compliance with the toxicity standards does not lie in the wholesale adoption of secondary biological treatment.

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[12] Norman Bonsor, et al., op. cit., p.7-134.

[13] D. McLeay, et al., Aquatic Toxicity of Pulp and Paper Mill Effluent: A Review, EPS 4/PF/1, Conservation and Protection, Environment Canada, Ottawa, April 1987, p.217.

[14] Ibid., p.59-60.

[15] Since the test can not be used to distinguish the severity of the toxicity problem among mills, the acute toxicity information presented in this report has to be interpreted with care. The effluent from a mill which tests as being toxic may be only moderately more toxic than a mill tested non-toxic.

Industry's view of the federal toxicity standard, as recorded during the course of this study, is that the toxicity standard should be changed (Table 5:8). This is shown in Table 5:10 where 66 percent of the 65 industry representatives included in the survey claimed that uncertainty about pending changes to toxicity regulations impedes long-term planning within the industry. The reason for industry frustration with the toxicity standard is that reductions in the use of water increases the amount of effluent concentration in mill discharges.[19] The test depends directly on the concentration of toxic substance in the effluent being tested. As the amount of water used in processing declines, the

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[16] See discussion on p.342.

[17] Norman Bonsor, et al., op. cit., p.1-16. See discussion on pp.113-114, Chapter Three.

[18] See discussion on pp.274-275, Chapter Four.

[19] Norman Bonsor, et al., op. cit., pp.7-125, 7-142.

TABLE 5:10

THE REASONS GIVEN BY PULP AND PAPER AND INDUSTRY REPRESENTATIVES FOR CLAIMING FEDERAL PULP AND PAPER REGULATIONS (OR GUIDELINES) IMPEDE LONG-TERM PLANNING WITHIN THE INDUSTRY - 1987

	Numbers[1]	Percentage
Uncertainty as to Pending Changes in Federal Requirements with Respect to Toxicity	43	66.2
Failure to Take Into Account Assimulative Capacity in Regulations	3	4.6
Competition Between Federal and Provincial Environmental Agencies	6	9.2
Lack of Research	2	3.1
Regulations or Guidelines Outdated	2	3.1
Inconsistent Enforcement of Regulations	9	13.9
	65	100.0

[1] Individual respondents sometimes referred to more than one opinion category.

Source: Industry and Provincial Agency Survey, 1987.

lethal concentration in a mill effluent rises.[20] Therefore, as water usage declines within the industry, it can be anticipated that a higher incident of test failure will occur. As the industry shifts to thermomechanical pulping process, and water usage decreases as a result, an increasing number of mills will find it more difficult to meet federal toxicity standards. As a consequence, industry officials feel constrained by the uncertainty associated with pending changes to federal requirements (Table 5:9).

This is not a new problem which has just arisen. The total water usage within the industry has declined rather substantially over the past twenty years. For example, a Canadian Pulp and Paper Association spokesperson estimates that water usage within the industry has been reduced by half over the period 1959 to 1986. This is confirmed by the experience in Ontario where water consumption among kraft mills has been reduced by more than half over the past two decades.[21] Reduced water usage is both desirable from an internal process control perspective, and is consistent with government efforts to encourage water and energy conservation. The toxicity standards, as currently specified, discourages the conservation of water, and to a more limited extent energy.

There are those that argue secondary biological treatment solves the concentration problem. Some of those who advocate secondary treatment support the view that low rate systems that involve longer holding retention periods will both reduce the level of toxicity and compensate for reduced water usage.[22] Those advocating this position cite at least two examples where this appears to have been true. While not denying the accuracy of these observations, there are a number of examples where the opposite is true. One recorded incident of this is in Ontario where a mill has secondary treatment and uses less than half the water of five of the eight other kraft mills in that province, and ranks among the worst on the basis of toxicity test results.[23] The different results at different mills might be due to the fact that some mills generate toxic substances, which are more readily broken down as a result of treatment. This would suggest that those mills with highly persistent toxic substances in their effluent would be most affected by lower water usage. Under such circumstances, the current test may be appropriate for identifying mills generating the more dangerous toxic substances. However, there is no evidence which supports this supposition. The use of secondary biological treatment may or may not compensate for reduced water usage. Nonetheless, it is not true for all existing mills operating in Canada at the present.

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[20] Ibid., p.7-125.
[21] Ibid., pp.7-136 and 7-137.
[22] See discussion p.194, Chapter Three, and subsequent discussion p.396.

Whether secondary biological treatment offsets the concentration problem or not, it is without question true that reduced water usage results in higher toxicity concentrations for mills not using secondary treatment. Without some provision in the regulations to standardise the test, an ever growing portion of the industry may be out of compliance with existing federal toxicity requirements. Some mills currently in compliance may not be in compliance in future. Perhaps some method can be found to allow for reduced water usage without lowering the existing standard. If this can be accomplished, then all mills should be provided with appropriate reduced water usage allowance. If it is not possible to establish a reduced water usage allowance without lowering existing standard, then government should resist any efforts to provide an allowance for only mills without secondary treatment. An allowance for only mills without secondary treatment would discourage other mills from adopting such measurements. If toxicity requirements are adjusted to allow for lower water usage, then it will have to be for all mills regardless of whether or not they have secondary treatment, unless federal authorities are prepared to discourage industry from adopting secondary treatment systems.

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[23] Norman Bonsor, et al., op. cit., p.7-141.

Unless evidence can be gathered to support the view that the test currently used distinguishes between persistent and non-persistent substances, or the Federal Government is prepared to require all mills to install slow rate biological treatment systems in hope that such treatment will offset the concentration problem, the toxicity test should be amended to allow for reduced water usage by standardising the test according to each process used across the industry.[24] This would not only be consistent with provisions provided for in the petroleum refining industry regulations,[25] but would allay any fears that industry might have about adopting newer technologies (CTMP and BCTMP) which require less water without detracting from the valuable influence of this regulation in protecting the environment.

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[24] It is recommended by the MISA Expert Committee on Kraft Mill Toxicity that the Ontario Government should use a maximum effluent flow of 175 cubic meters per tonne of air dried pulp produced for their static test of acute lethal toxicity for kraft mills in that province. The simple calculations necessary to standardise the test are given in the report. Loc. cit.

[25] Petroleum Refinery Effluent Regulations and Guidelines, Regulations Codes and Protocols, Report EPS 1-WP-74-1, Water Pollution Control Directorate, January 1974, p.28.

In a more positive vein, it should be noted that the toxicity loadings information contained in this report does not take into account the lower water usage within the industry since 1971. It is based on total flow or water usage and on the pass/fail designation, as determined in the test. Therefore, the calculations are a valid measure of the total effluent discharge deemed to be acutely toxic, but are not a valid indicator of the degree of toxicity. It is highly likely that most mills have reduced the water flow and reduced the amount of toxic substances in their effluent only to continue to test toxic, because of increased effluent concentration. If the industry were operating using the same amount of water that was used back in 1971, it could be expected that compliance with existing regulations would be much higher than indicated in this report. In fact, it appears as if the industry has made major progress in reducing its total toxicity loadings since 1971. This is not revealed by the information provided in this report, because no allowance has been made for reduced water usage.

Another criticism of the federal acute toxicity test is that the test results vary with the amount of pH in the water. The pH levels in salt water is usually slightly higher than in fresh water, although they do not fluctuate as greatly in salt water as in fresh water. Federal toxicity regulations do not require the use of receiving waters in its effluent toxicity test. This is another item that should be taken into account when amendments to the federal regulations are considered.

The value of federal regulations at least partially rests on their effect in helping to standardise the pollution control requirements across the industry. The EP should continue to encourage consistency among and between the provinces wherever possible. There is no apparent reason why all provinces do not use the same toxicity standard, or why federal toxicity limits are in variation with those used by some of the provinces. Quebec uses an LC20 = 65 static test, as do the Maritimes and the Prairie provinces. Ontario uses an LC50 = 100 static test in most cases.[26] British Columbia uses five different static test requirements. It is without question the right of each province to set standards, which they feel are appropriate. The flow-through test provision in the federal regulations is more expensive to conduct than a static test, but it could be argued that it more accurately represents natural conditions in receiving waters, when the water being used in the test is taken from these same waters. The flow-through test also is desirable since all conditions of exposure are kept more or less constant.[27] Some effort should be made to standardise the test so that all mills have at least similar, if not the same, toxicity control requirements.[28]

The information and discussion carried out in this section suggests support for amending the current federal toxicity requirements. This should not be interpreted to mean that the federal toxicity standards should be lowered. The water use reductions, which have taken place over the years, probably have resulted in a standard more stringent than was originally intended. Some adjustment for this should be made to allow for the use of more water efficient processes. However, the original toxicity standard has not been shown to be beyond the ability of industry to meet. If at all possible, any amendments to the regulations should be structured in such way, so as not to relax the standard which was set in 1971. Federal toxicity regulations should require the use of water taken from receiving waters for determining acute toxicity. An effort should be made to standardise the test so that it is consistent with provincial toxicity standards. Where appropriate, the provinces should be encouraged to standardise their tests so that the industry has to meet the same toxicity standard in all parts of Canada.

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[26] Norman Bonsor, et al., op. cit., pp.7-138-7-139.

[27] Ibid, p.7-126.

[28] Differing federal and provincial standards do not necessarily invalidate either one or both in law. Legal interpretations suggest that the accused is not necessarily in a position, whereby compliance with one law places him in breach of the other, when standards are different. Mill operators merely have to comply with the higher standard in order to satisfy the law. See Alastair R. Lucas, "Natural Resource and Environmental Management: A Jurisdictional Primer", Environmental Protection and the Canadian Constitution, Proceedings of the Canada Symposium on Jurisdictional Responsibility for the Enviroment, ed. Donna Tingley, Environmental Law Centre, Alberta, 1987, p.35.

Persistent and Sublethal Toxic Substances

The bioassay test established by the Federal Government more than sixteen years ago was specifically designed as a "catchall" to control all of the toxic substances discharged by a mill. It was recognised at the time that all toxic substances from a pulp mill could not be measured or contained, and some method had to be established to protect the interests of the public even though knowledge was limited. The knowledge acquired since 1971, suggests that the test remains a valid vehicle for determining when effluent is acutely toxic to fish. Since resin and fatty acids are known to be responsible for the largest portion of the total toxicity in pulp mill waste, and resin and fatty acids are natural substances which are believed to readily breakdown in the environment,[29] the use of the bioassay test remains particularly valuable for controlling pulp mill waste. Since fish are present in virtually all receiving waters where mill effluent is discharged, fish probably are the most appropriate organism for monitoring acute effluent toxicity.[30] However, the bioassay test does not provide a basis for predicting toxic effects caused by prolonged exposure to sublethal concentrations of toxic materials.[31] It does not allow for a distinction between persistent and non-persistent substances or serve as an adequate indicator for chronic effects.

Chlorinated resin acids are found in bleach kraft mill effluent. Chlorinated resin acids are more resistant to biodegradation than their non-chlorinated counterpart.[32] Chlorophenols are known to be present in sublethal concentrations in the receiving waters near bleaching pulp mills, when effluents are not biotreated.[33] Organochlorines are found in bleach kraft mill waste. Although these chlorinated organic substances eventually might prove to be less harmful than currently claimed by some environmental activists, they are known to be deleterious. They also are known to be persistent and bioaccumulative. Those familiar with chlorinated organics feel that only a small portion of these toxic substances have been discovered.[34] They usually are present in such minute amounts that no effective way for measuring, controlling, or treating such substances is likely to be found within the foreseeable future. Therefore it is recommended that efforts be undertaken to require the industry to adopt mechanisms, which will remove organochlorines at the source.

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[29] McLeay, *et al.*, *op. cit.*, pp.173-175.

[30] The use of fish for testing toxicity in mill waste is consistent with the federal jurisdictional obligation to protect fish and fish habitat.

[31] McLeay, *et al.*, *op. cit.*, p.216.

[32] *Ibid.*, p.5.

[33] *Ibid.*, p.29.

[34] It has been estimated that about 200 of the roughly 300 different compounds found in bleach pulp mill effluents are chlorinated organic compounds. Douglas Reeve, Paul F. Earl, *Chlorinated Organic Compounds in Bleached Chemical Pulp and Paper Effluents: Part 1 The Potential for Effluent Regulations*, Spring Conference Canadian Pulp and Paper Association, May 19-21 1988, Technical Section Pacific Coast and Western Branches, Department of Chemical Engineering and Applied Chemistry, University of Toronto, p.1.

The reasons for this particular recommendation are numerous. They include:

(1) As witnessed by the recent highly publicised situation with dioxins, there is a great and growing concern about such substances amongst the public.

(2) The source of organochlorines in a pulp mill is known with a reasonable degree of certainty.

(3) Organochlorines are persistent substances that enter the food chain through fish or their prey, and are therefore, a federal concern.

(4) Organochlorines are a transboundary problem that is both national and international in scope, which could have trade implications without federal intervention.[35]

(5) Organochlorines are becoming the focus of concern in a growing number of countries throughout the world.[36]

(6) It is a complex problem of major proportions which will require substantial resources over many years if it is to be fully understood and eventually controlled. As such, it is a problem that appears to require a commitment from

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[35] It has been noted by some observers that "Europeans have indicated their intention to restrict imports of pulp and paper products which contain organochlorines". See Norman Bonsor, et al., op. cit., p.1-17.

[36] The Swedish Government has placed considerable emphasis on controlling organochlorines over much of the last decade (See p.385).

each province and the Federal Government to satisfactorily address.

(7) There exists proven technology to control organochlorines reasonably efficiently.[37] Chlorine dioxide substitution can reduce organochlorines by up to 50 percent.[38] Oxygen delignification can reduce organochlorine and colour by around 50 percent.[39]

(8) It has been estimated that there are potential cost of production savings as a result of using oxygen delignification.[40] High chlorine dioxide substitution is considered an economically attractive method to reduce organochlorines.[41] The higher the chemical costs, the greater the potential savings that can result from oxygen delignification.[42] The overall chemical costs have been estimated to be unaffected by chlorine dioxide substitution of up to 50 percent for most mills in Ontario.[43]

(9) Organochlorines represent a problem, that in the opinion of some, is of such major importance that it surpasses the toxicity problems which are associated with resin and fatty acids.

The regulated limits (and proposed limits) for those nations which already have established controls for chlorinated compounds are as follows:[44]

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[37] An estimated 53 additional mills will have oxygen delignification systems by 1990. Norman Bonsor, *et al*., *op. cit*., p.3-58.

[38] *Ibid*., p.3-48.

[39] *Ibid*., p.12-214.

[40] *Ibid*., p.12-211.

[41] *Ibid*., p.12-215.

[42] Chemicals in the pulp and paper industry average between twelve and sixteen percent of the total cost of producing one air dried tonne of pulp at the mill level in Canada. The cost of chemicals are expected to continue to increase over time.

[43] Norman Bonsor, *et al*., *op. cit*., p.12-215.

	TOCl Discharge (kg/t)	Proposed Date for Compliance
West Germany	1.0	1989
Finland	1.5	2000
Norway	2 to 2.5	1991
Sweden	1.3 to 5.5	1988
Sweden	1.5	1992
Sweden	0.1	ca 2010

It should be noted that this information is provided solely for the purpose of showing the concern being demonstrated in other nations throughout the world. It is not suggested that the standards adopted by other nations are appropriate or necessary in Canada.

International Considerations

The international responsibilities that have become an integral part of the regulatory activities of EP include: (1) exchanging information with environmental agencies of other countries, (2) conducting fact finding missions to learn of new technical approaches that have worked elsewhere, (3) dealing with environmental problems which cross international boundaries, and (4) as necessary providing industry and provincial environmental authorities with information to aid them in their efforts to control pollution. These activities generally are considered appropriate to federal international responsibilities. When these international activities are coupled with the control of toxic substances, or with other pollution problems which individual provinces cannot be expected to satisfactorly address, it is ventured by some legal experts that they fit relatively easy into the core of federal jurisdiction.[45]

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[44] A.G. Colodey, Impact of Pulp and Paper Mill Effluents in Sweden, Finland and Norway: Emphasis on Chlorinated Compounds, Draft Unpublished Discussion Paper, Environmental Protection, West Vancouver, July 1988, p.1.

There are a number of practical considerations which appear to suggest that EP should place greater emphasis on international activities, as they relate to the pulp and paper industry. The industry has for many years been a major economic activity internationally. As was seen in Chapter One, Canada is one of the world's largest producer of pulp and paper products. The international appreciation for the need to control pollution has increased substantially in the years since the regulations were first introduced. For example, it has been observed that there are only eight national environmental agencies in other countries in 1972. By 1986, the number of national environmental agencies had grown to 113.[46] This considerably increases the complexities associated with maintaining up-to-date information on an international industry the size of the pulp and paper industry. As well, there appears to be a growing interest among industry and provincial agencies spokespersons for EP to monitor trends in pollution control technology both nationally and internationally, and to make such information available to those working on controlling the industry's pollution.[47] The consensus among industry and provincial environmental agency spokespersons is that EP should take an active role in encouraging consistent environmental control standards across Canada (see Table 4:28). According to Table 5:11, 64 percent of industry and 75 per-

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[45] Alastair R. Lucas, op. cit., p.39.

[46] Dr. Robert W. Slater, "The Federal Perspective", Environmental Protection and the Canadian Constitution, Proceedings of the Canadian Symposium on Jurisdictional Responsibility for the Environment, ed. Donna Tingley, Environmental Law Centre, Alberta, 1987, p.7.

[47] See discussion on pp.338 and 339.

TABLE 5:11

THE IMPORTANCE OF MAINTAINING CONSISTENCY IN PULP AND PAPER INDUSTRY ENVIRONMENTAL CONTROL STANDARDS BETWEEN CANADA AND THE UNITED STATES ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES AND PROVINCIAL AGENCY OFFICIALS

	Industry and Mill Representatives										Agency Officials	
	British Columbia		Ontario		Quebec		Atlantic/ Prairies		Canada		Provinces	
	#	%	#	%	#	%	#	%	#	%	#	%
Very Important	0	0	1	8.3	0	0	1	10.0	2	4.0	2	25.0
Important	4	36.4	5	41.7	16	94.1	5	50.0	30	60.0	4	50.0
Not Important	7	63.6	5	41.7	0	0	4	40.0	16	32.0	2	25.0
No Opinion	0	0	1	8.3	1	5.9	0	0	2	4.0	0	0
TOTAL	11	100.0	12	100.0	17	100.0	10	100.0	50	100.0	8	100.0

Source: Industry and Provincial Agency Survey, 1987.

cent of the provincial agency spokespersons feel that it is also important to maintain consistent, but not necessarily the same, standards between Canada and the United States. The trend internationally is to recognise pollution control efforts of each country as being an item in which all other countries have a legitimate interest. This is particularly so when countries share common borders, or when the pollution from one nation impacts on the environmental quality of another.

A recent speech at a luncheon for King Carl XVI Gustaf and Queen Sylvia of Sweden by Jim Bradley, the Minister of the Environment for Ontario, reflects the growing sentiment for better international and national coordination for pollution controls. In his statement Mr. Bradley stated:

> Having taken strong practical and expensive steps to clean up our own backyards, Sweden and Ontario have earned the right to expect the same of our neighbours.[48]

This statement not only serves to emphasise the importance of having the provinces in Canada move forward in tandem in controlling pollution from industry, but underlines the importance of international cooperation in dealing with pollution matters which directly and indirectly affect other nations. It emphasises the need to work in conjunction with other nations to avoid any negative implications that may arise from failure to address pollution problems within Canada's national boundaries (as would be the case if, as noted above, a group of European countries were to restrict the import of pulp and paper products containing organochlorines).

The United States

There is no other country where the need to work in cooperation on pollution matters is more clearly evident. Aside from sharing a continent-wide border and using the same lakes and waterways, the United States is Canada's largest market for pulp and paper products. The linkage within the industry between the countries is both long-standing and strong.[49] There are many international environmental forums in which both Canada and the United States participate. Despite this there exists in Canada a number of misconceptions about the United States' regulative efforts to control pollution from the pulp and paper industry.[50] These misconceptions are dangerous.[51] They might contribute to lost opportunity, because there is much to be learned from the United States' experience.

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[48] "Swedish King Hears Attack on Pollutors", The Vancouver Sun, March 16, 1988, p.A7.

Pulp and paper mills in the United States are designated under four industry classifications which include pulp and paper mills, paperboard mills, and manufacturers of roofing felt, and industrial paper. Using these classifications, it can be estimated that there are approximately 577 pulp and paper mills (excluding converting mills) in the United States. About 326 of these mills are direct discharge mills. Unlike the approach used in Canada, emphasis in the United States has been on setting discharge limits over a number of output categories and subcategories according to process used and the product produced.[52] Federal regulations were originally established on the basis of best practicable technology (BPT), which basically required the installation of secondary treatment. Consequently, virtually all mills (large and small) in the United States have secondary biological treatment systems (Appendix IV).

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[49] More than 30 of the 82 companies involved in pulp and paper manufacturing in Canada operate in the United States. See Chapter Six.

[50] Norman Bonsor, et al., op. cit., p.6-113 and p.12-220.

[51] The "unfair" subsidy provision under U.S. trade remedy law allows for firms or industries to seek countervailing action on a range of Canadian exports. The U.S. Mining Association feels that the emission-control subsidies available to Canadian mining enterprises is a legitimate case for countervailing action. Reaching Outwards, Twenty-Fourth Annual Review Economic Council of Canada, Supply and Services Canada, Ottawa, p.25 and p.46.

[52] National Technical Information Service, Water Pollution: Application of National Cleanup Standards to the Pulp and Paper Industry, General Accounting Office, Washington D.C., March 1987.

In 1977, the Clean Water Act was amended to require incremental reductions in pollutants over and above BPT, to what were referred to as best conventional pollutant control technology (BCT). In conjunction with the BCT, the EPA (Environmental Protection Agency) established a fairness test referred to as the Public Owned Treatment Works test. This test required a comparison between the cost to industry (not toxicity) and the costs imposed on an average sized publicly owned treatment facility as a result of removing conventional pollutants. EPA efforts to invoke BCT resulted in a court challenge in July of 1981. The court held, that in addition to the fairness test already developed, the Clean Water Act required EPA to consider one additional test of reasonableness as part of the BCT methodology.[53] This test was referred to as the industry cost of effectiveness test, which required a comparison between BCT and BPT for the incremental cost per pound of pollutant reduction. This precipitated a series of reviews and interchanges between industry and government that eventually resulted in the EPA accepting that BCT and BPT are equivalent requirements. With this decision, the economic tests were no longer required and BPT once again became the prevalent control strategy.

More recently, the EPA has adopted control standards based on what is referred to as best available technology economically achievable

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[53] U.S. Environmental Protection Agency, Development Document for Best Conventional Pollutant Control Technology Effluent Limitations Guidelines for the Pulp, Paper, and Paperboard and the Builders' Paper and Paperboard Mills, Industrial Technology Division, EPA440/1-86/025, 1986, p.5.

(BAT). With this, the EPA began a process which appears will eventually move them away from predominately technically based standards to water quality standards, with greater emphasis on controlling toxic pollutants. It is apparent that the regulative process used in controlling waste from pulp and paper mills in the United States is far more complicated and confrontational than in Canada. The question is whether the results in that country have been better than in Canada.

A comparison between EPA TSS and BOD discharge limits and Ontario provincial and federal limits for the same effluents is provided in Table 5:12. According to the information in this Table, if EPA TSS and BOD limits were applied to the 28 mills in Ontario, the EPA TSS limits would be more stringent than either federal or provincial limits for seventeen of the 28 mills in Ontario. EPA limits for BOD would more stringent than federal or provincial limits for 20 of the 28 mills.[54] Since Ontario provincial limits are at least as stringent as the limits of other provinces, it can be concluded that TSS and BOD limits in Canada generally are less stringent than in the United States.[55] Although the United States did not require testing for toxicity discharge until 1982, their federal toxicity requirements are known to be more stringent than those used in Canada.[56]

More stringent requirements do not necessarily imply that the specified standards are enforced. However, an examination of the information available, and a review of the material provided for area 10 (which

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[54] Norman Bonsor, et al., op. cit., p.6-110.

[55] Ibid., p.6-109.

[56] Ibid., p.6-111. This also is revealed in a review of mill permits.

TABLE 5:12

A COMPARISON AMONG PROVINCIAL, FEDERAL AND ENVIRONMENTAL PROTECTION AGENCY (UNITED STATES) COMPLIANCE STANDARDS FOR TOTAL SUSPENDED SOLIDS (TSS) AND BIOCHEMICAL OXYGEN DEMAND (BOD) AS THEY RELATE TO THE TWENTY EIGHT DIRECT DISCHARGE MILLS IN ONTARIO - 1985

	TSS		BOD	
	#	%	#	%
Provincial Limit Most Stringent	3	10.7	0	0
Federal Limit Most Stringent	2	7.1	0	0
EPA Limit Most Stringent	17	60.7	20	71.4
Information[1] Unavailable	6	21.4	8	28.6
TOTAL	28	100.0	28	100.0

[1] The information unavailable does not include any of the same mills for both TSS and BOD.

Source: Report On Industrial Discharges In Ontario, Ontario Provincial Government, 1986.

includes Alaska, Washington, Oregon, and Idaho) indicates that discharge limits for all regulated substances are vigorously enforced. When monthly average and daily maximum loadings limits are exceeded, charges are usually laid. Some state authorities are less restrictive than others, but it appears that the EPA will intervene when standards are considered overly lenient.[57] It also is possible for mills to obtain exclusions through the courts, but such exclusions are resisted. Nonetheless, they are sometimes granted along with onerous additional requirements.

Two mills in Eureka, California, located on Humboldt Bay, were given concessions through amendments to the Water Pollution Control Act, Section 301(M). These mills were given special variances to avoid putting in primary or secondary treatment, because they were only two of five mills in the country which discharge directly into open marine waters. These plants were required to adopt specific plant modifications and to carry out detailed monitoring and biological assessment programs. In one case, the company is required to spend not less than $250,000 per year for ten years on a research and development program. The $250,000 annual expenditure is not to include expenses for travel by the project manager or the costs of full-scale equipment installation. This same company is required to undertake a monitoring program which involves documenting the short and long-term effects of discharge into receiving waters, determine compliance with the terms and conditions outlined in its permit, and assess the effectiveness of its toxic control program. The permit does allow monitoring frequency to be reduced after one year from quarterly sampling, if the EPA chooses not to reopen the requirements as a result of the monitoring information that is acquired. Overwhelmingly, the information that is available on the regulative approach adopted in the United States suggests that the regulations are enforced by federal authorities, and exceptions do not allow mill operators to avoid responsibility for protecting the environment from mill waste. However, individual states often take the lead in regulating the industry, and requirement standards do vary among mills. State enforcement practices also are known to vary.

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[57] An example of eleven mills in Wisconsin is cited in a recent MISA report, where toxicity requirements were upgraded as a result of EPA vetoing the issued permits which did not set specific toxicity limits and provide for sufficient monitoring. Ibid., p.6-115.

The National Council of the Paper Industry in the United States conducts an annual survey to determine the capital expenditures made on pollution controls within the industry. The Canadian Pulp and Paper Association, using essentially the same methodology, undertakes similar annual surveys in Canada. Thus, the industry associations of the two countries are gathering the same information, which can be used to provide what should be a consistent (if not totally accurate) comparison between industry efforts in Canada with the United States. This information is provided in Table 5:13 which shows the capital expenditures for controlling pollution in both air and water as a percentage of total capital expenditures for both countries' industries. According to this information, in percentage terms, the United States industry spent roughly twice as much as the Canadian industry over the years 1972 to 1976. Presumably, this is because of the secondary treatment requirement in the United States. Since 1976, the industry in Canada has devoted a somewhat greater percentage of its total capital expenditures on pollution control abatement.

Even though limited information is available on waste reductions

TABLE 5:13

CAPITAL EXPENDITURES ON CONTROLLING EFFLUENT DISCHARGE AND AIR EMISSIONS AS A PERCENTAGE OF TOTAL CAPITAL EXPENDITURES BY THE PULP AND PAPER INDUSTRIES IN CANADA AND THE UNITED STATES 1971 TO 1985

	Canada	United States
	%	%
1971	17.1	-
1972	11.5	38
1973	8.6	34
1974	14.1	31
1975	19.0	30
1976	15.2	29
1977	14.9	19
1978	17.6	16
1979	10.0	12
1980	10.2	9
1981	11.5	6
1982	17.9	9
1983	15.9	6
1984	10.0	6
1985	6.6	7

Sources: Canadian Pulp and Paper Association, National Council of the Paper Industry for Air and Stream Improvement, Survey of Pulp and Paper Industry Environmental Protection Expenditures, 1986, Special Report No. 87-09. Statistics Canada, Capital Expenditures, Catalogue 6124, Ottawa, 1985.

in the United States, the solid waste discharge decreases for the United States Paper and Allied Products Manufacturers is available for some years. Solid waste removals from the Paper and Allied Products Manufacturers in the United States over the ten year period 1974 to 1983 amounted to about 54.5 percent.[58] In comparison, TSS and BOD reductions for the pulp and paper industry in Canada between 1970 and 1985 amounted to 49 percent. These same effluents were reduced in Canada over the eight year period 1978 to 1985 by 37 percent. Canada has been enforcing toxicity requirements over a much longer period than in the United States. When allowing for water usage reductions it can be estimated that significant progress has been made in reducing acute toxicity discharges in Canada. The short retention time secondary treatment systems used by many mills in the United States are less efficient for removing toxicity than longer retention systems. Short retention time systems are known to regularly lose efficiency because of variations in mill raw effluent. They increase the risk of environmental accidents when they are used as the main component of a mill's water pollution control system.[59] The environmental performance of mills in the United States cannot be considered better than mills located in Canada. Much depends on the efforts of the individual states in enforcing their more recently established toxicity requirements, and on the efficiency of the spill control systems which have been adopted.

Canada with comparatively limited resources does not appear to significantly lag behind the United States in controlling effluent discharges from the pulp and paper industry. It would seem that the across-the-board requirement for secondary biological treatment has not necessarily resulted in appreciably large differences in environmental performance. The selective use of biological treatment appears justified, when circumstances dictate. Mills in the United States have been able to install biological treatment systems, which similar sized mills in Canada claim they cannot afford.[60] The declining percentage of total capital expenditures being allocated to pollution controls by industry in the United States appears to confirm the observation made earlier, that the use of biological treatments can result in reducing the long-term costs of pollution controls in mills obligated to reduce discharges consistently over time.[61] The selective use of biological impact assessments to justify variances is being used in the United States, and industry appears to be able to absorb the shared costs of this work. The complicated system of controls which has been developed in the United States does not appear to be necessary in Canada to protect the environment and should be avoided.[62] Nonetheless, the emphasis placed on secondary treatments in the United States seems to have put mills in that country in a better position for major effluent reductions in future at considerably lower costs than is likely to be true in Canada.

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[58] Environmental Quality, The Fifteenth Annual Report on Environmental Quality, U.S. Printing Office, Washington, D.C., 1984, p.610.
[59] Norman Bonsor, et al., op. cit., p.5-85.

Scandinavia

The Swedish and Finnish pulp and paper industries are often pointed to as world leaders in technology development and producers of high quality paper products.[63] They also are considered to be world leaders in controlling pollution from their mills. The technologies to control pollution from the pulp and paper industry in these two countries are the same as in Canada. However, the attitudes and emphasis placed on controlling particular pollutants are different than in Canada.

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[60] Government assistance programs for pollution control is discussed in Chapter Six.

[61] See p.127 Chapter Two.

[62] This also is the finding of some EPA officials, who support regulating broad categories of effluent discharges rather than focusing on particular wastes and chemicals.

As of January 1987, there were 83 operating mills in Sweden and 51 in Finland. Although the Swedish industry is many times larger than the Finnish industry, pulp and paper production in Finland is more important to the national economy and represents about eight percent of that nation's gross national product (compared to about six percent in Canada). Eleven mills in Sweden have secondary biological treatment systems, and 22 of Finland's mills have similar treatment.[64] The Finnish pulp and paper industry reduced TSS releases by roughly 80 percent and BOD discharges by about 39 percent over the period 1970 to 1985. During that same period, Swedish mills reduced both TSS and BOD discharges by between 60 and 70 percent. In both countries, it is believed that the measures taken during the 1960's and 1970's to protect the marine environment have been successful to the point where most problems with oxygen deficiency and fish kills have been solved.[65] In both countries, there has been an increasing effort on reducing chlorinated organics. Both countries monitor the use of chlorine and encourage its reduced consumption.

Although both countries have been successful in reducing traditionally controlled effluents, the approach used in the two countries differ quite considerably. Finland has generally adopted a biological treatment approach. In Sweden the emphasis has been on internal controls. Since the middle of the 1970's, Sweden has focused increasingly on environmental effects monitoring. Finland's research is concentrated on sublethal and physiological effects, the mechanisms that give rise to these effects, and on mutagenics.[66] The studies undertaken in Finland focus mainly on the impact effects of discharges on the immediate environment, while Sweden tends to focus on the environmental effects over a somewhat wider range of time and space.[67] In Finland, it has been found that biological treatment will remove chlorinated phenolic substances from effluent. This also has been true in Sweden, but environmental authorities in Sweden attribute noticeable reductions in chlorinated organic materials to the increased use of oxygen for prebleaching. They also maintain that the substitution of chlorine dioxide for chlorine has contributed to decreasing the discharge of these same substances.[68]

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[63] Wayne Karl, "The Finnish Report", Pulp and Paper Journal, Vol. 40, No. 8, October 1987, p.23.

[64] Report of Special Working Group, Water Pollution Problems of Pulp and Paper Industries in Finland and Sweden, Committee of the Gulf of Bothnia, Naturvardsverket Rapport 3348, May 1987, Appendices 1 and 2.

[65] Ibid., p.8.

There have been complaints by Swedish industrialists, that the country's environmental laws are "too tough", and may result in industrial (not just pulp and paper mill) plant closure.[69] As well, there are complaints in Sweden about pollution damage to the forest base, and the environmental degradation of water.[70] The government response to these apparently opposing positions appears clear. The Swedish government is pressing ahead with a comprehensive plan for reduced marine pollution.[71]

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[66] Ibid., p.39.

[67] Ibid., p.9.

[68] Loc. cit.

[69] "World Report", Pulp and Paper Journal, Vol. 41, No. 1, January 1988, p.21.

[70] "World Report", Pulp and Paper Journal, Vol. 40, No. 7, September 1987, p.21.

[71] Jeannine Mitchell, "Sweden Launches New Assault on Pollution", The Financial Post, March 23 1987, p.14.

The pulp and paper industry is considered the largest discharger of stable chlorinated organic material. The National Swedish Environmental Protection Board believes it is both technically feasible and economically possible to reduce chlorinated organic discharges.[72]

Data on pollution control expenditures of the pulp and paper industries in Sweden and Finland are not available in a form which can be compared with the expenditures provided by the Pulp and Paper Association in Canada. Capital expenditures on pollution controls are expected to increase in Sweden for the remainder of the decade. Finland appears committed to rehabilitating its forest base, modernising its industry, producing higher value added products, and keeping pollution under control. Swedish officials claim that one of the reasons its industry is technically advanced is because of mills having to continually upgrade their internal control measurements. Industries in both countries can be expected to make modest decreases in conventional pollutants through the 1990's, but very large reductions in chlorinated organics.

Despite having limited data available for assessment in this report, it would appear fairly safe to conclude that the Swedish government will continue to concentrate on eliminating chlorinated organic discharges. It also would appear safe to conclude that the Finnish government will be placing more emphasis on controlling chlorinated organic substances in future. This might come as a result of market resistence to products containing chlorinated organics (about 74 percent of Finnish exports are to European markets), or it may come as a result of pressure by Sweden (both countries discharge their waste materials into the Baltic Sea). Both countries appear committed to biological impact assessment, although with different emphasis. The Finnish government with its early focus on biological treatment appears to be in a good position to encourage the internal controls necessary to reduce chlorinated organics. The Swedish government will continue to press for internal controls, but in recognition of the value of external treatment in eliminating chlorinated phenolic substances, probably will encourage the use of both internal and external control measures. If the pulp and paper industries in these two countries can in fact be considered industry leaders in worldwide technology, then it would appear the future lies in controlling organochlorinates.

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[72] Norman Bonsor, et al., op. cit., p.6-120.

The Use of the Federal Fisheries Act to Regulate Effluent Discharges from the Pulp and Paper Industry.

The discussion in Chapter Three indicated that the use of the Fisheries Act, as the legislative basis for enforcing industry effluent regulations, poses some problems for officials responsible for enforcement. Legislation specifically designated for the purpose of fish management carries with it the implication that the responsibility for enforcement of the pulp and paper effluent regulations should be divided in the same way as the enforcement of the Fisheries Act itself. The use of the Fisheries Act also serves to divert attention away from more general responsibilities that EP has for the environment.[73] However, it can be seen from the United States' experience that a regulative approach which focuses on controlling individual substances results in an extremely complicated regulative approach. Not only is the approach complicated, it would be extremely expensive. The cost of testing and establishing protocols for potentially hundreds of substances (known and yet unknown) might prove prohibitive.[74] Thus, the regulative approach adopted in Canada is both efficient and effective when compared to the alternatives. The general provisions under Section 33 of the Fisheries Act, which defines harmful discharges (including toxicity), on the basis of impact on fish is appropriate to federal jurisdictional responsibilities and provides sufficient latitude to deal with the unpredictable consequences which can result from discovering new harmful substances.

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[73] See Chapter Three, pp.196 to 202.

The EP has been most successful in setting up a cooperative system to deal with pollution from the pulp and paper industry. The industry has benefitted as a result of better coordination. Government authorities have benefitted, and so has the Canadian public. It is the use of the Fisheries Act that has allowed EP to make these improvements. The use of the Fisheries Act requires federal departments to coordinate their efforts and to take into account each of the various views that pertain to a particular problem. To the degree that provincial authorities use the Fisheries Act to manage local fisheries stock, there must be interaction between provincial and federal officials. This might not continue to be the case, if the Fisheries Act is not maintained as the basis for the pulp and paper effluent abatement regulations. Others who share responsibility for administering the Fisheries Act, might choose to act independently on matters which have implications on a number of different resource areas and the general environment. The Fisheries Act should be maintained as the legislative basis for federal efforts to control effluent discharges from the pulp and paper industry.

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[74] Norman Bonsor, et al., op. cit., p.1-6

The intention here is not to suggest that additional legislation cannot, or should not, be used to supplement or reinforce federal efforts to control pollution from the pulp and paper industry. There may come a time when the use of the Fisheries Act becomes inappropriate or even redundant. The position put forth here is that the Fisheries Act has been used successfully by EP for controlling waste discharges from the industry. The pulp and paper industry is a complex and complicated industry which discharges a range of both known and unknown substances. The Fisheries Act provides sufficient latitude to deal with these complexities. It should be maintained as the primary legislative basis for regulating the industry, until such time that some other legislative mechanism is proven to be at least as effective as the Fisheries Act, and the regulations that have been adopted under the authority of the new legislation.

Summary

In this Chapter, the appropriateness of the current regulative approach was examined in terms of the alternatives available for controlling pollution from the pulp and paper industry into the 1990's. It was established that the role laid out by the Federal Government in the early 1970's remains appropriate for the 1990's. The essential features of this role as supported by industry and officials from the provinces are to: (1) maintain minimal discharge standards which can be applied to all of the industry nation-wide, (2) undertake those activities necessary to coordinate federal activities and maintain a regulatory atmosphere that is conducive to sound business practices and helping to keep the industry competitive internationally, and (3) protecting fish and fish habitat on the basis of federal obligations under Section 33 of the Fisheries Act.

The specific approach supported by provincial environmental officials and by industry is for the provincial governments to continue to assume the lead role for setting regulations and enforcement at the local or regional level. The federal standards are preferred as minimum standards, which are to be enforced only as necessary to achieve fair and equitable distribution of effluent loading reductions across industry. The EP is considered responsible for specifying toxicity requirements, that can be applied as standards for the industry. Overwhelmingly, the industry wants assimilative capacity and biological assessment to be taken into account when applying federal regulations. Other specific concerns of industry include amending federal toxicity standards and measurements, greater effort on research and the dissemination of information, more emphasis on developing a better understanding of the economics of the industry, and greater consistency in enforcement nation-wide.

The information presented in this report indicates that the TSS and BOD limits used in Federal Regulations are minimal standards, which do not necessarily ensure the long-term protection of fish and fish habitat. The acute toxicity standard can be described as a medium lethal requirement which can be used on a nation-wide basis to provide a minimal acceptable level of environmental protection from the effluent discharges caused by industry.

A review of the distribution of effluent loadings among mills in the industry confirms wide differences in the environmental performance. Fifteen percent of mills (about eighteen mills) account for approximately 32 percent of the average daily production of Canada's direct discharge mills. Fifteen percent of these mills account for 42 percent of TSS loadings, nearly 50 percent of BOD discharges, and roughly 57 percent of the average daily acute toxicity loadings. At the other extreme, 30 percent of the mills (approximately 36 mills), which appear to be performing well in reducing their loadings account for ten percent of the production, roughly five percent of the TSS loadings, two percent of BOD, and virtually no toxicity discharge. The fifteen percent highest loadings mills are not the same mills in all effluent categories. Neither are the 30 percent lowest loadings mills the same mills in all categories. Nonetheless, this information does indicate that a relatively small number of mills are responsible for a very large amount of the loadings in each effluent category.

A more detailed breakdown of the distribution of the loadings among mills in the industry shows that major reductions in loadings can be achieved if federal regulations were enforced across the industry. Regional performance variations among industry components could be reduced if all mills were in compliance with federal regulations. Major reductions could be achieved if a small number of the highest loadings mills were to reduce discharges to the median level of loadings for all mills in the industry. Despite these observations, it was found that five of the eleven highest loadings mills in the TSS category are considered in compliance with TSS federal standards. Six of the eleven highest loadings mills in the BOD category were in compliance with federal standards. Some of the eleven highest toxicity loading mills in Canada also are considered in compliance part of the time.

The variations and distribution of loadings among mills in the industry indicates three things. First, the use of provincial standards as a substitute for federal limits has not resulted in an even distribution of loading reductions across regions or among industry components in Canada. Second, the federal requirements are appropriate to the current circumstances in the industry, and it appears feasible for the majority of mills in the industry to meet the federal discharge limits. Third, variations in environmental performance among mills depends to a considerable degree on the pulping process used, but it also appears to depend on efforts undertaken to enforce the regulations.

An assumption implicit in technically based regulations is that the greater the production from a mill, the greater the effluent loadings generated. It also is implicitly assumed that the larger the level of loadings from a mill, the more environmentally disruptive the mill operation. The logic of this can not be refuted. It is obvious that without industry there would be no effluent loadings from pulp and paper manufacturing. If the effluent loadings from the industry were reduced to zero, there is high probability there would be a vast improvement in the nation's water quality and environment. However, the large production mills are not necessarily the highest loading mills. Loadings levels do not necessarily determine the degree to which a mill operation impacts on the environment. Under such circumstances, it would seem reasonable to allow certain mill operations more time to meet federal standards, when circumstances dictate. It would seem reasonable to expect that some mill operations would be required to meet more stringent effluent discharge standards, when it is clear that minimal standards do not provide adequate protection for fish and fish habitat. When such exceptions are deemed justified, they should be validated and negotiated on the basis of the evidence gathered by biological impact assessment.

The selective use of environmental impact analysis to set standards for individual mills has numerous advantages. First, over the longer-term it would encourage new mills to locate in less environmentally sensitive areas. Second, it could be used to set standards for dealing with those mills, which due to circumstances at the individual facility, are not operating in accordance with limits specified in the regulations. Third, it would avoid some of the uncertainty associated with the ill-defined "best practicable technology". Fourth, it would encourage better cooperation from industry. Fifth, it would lend further support to the basic principle that fairness does not necessarily depend on having the same discharge limits applied to all mills in Canada, but in requiring mills operating in the same types of environment and under the same technical circumstances, to meet the same restrictions. Sixth, it would help focus attention on the main responsibility of protecting the environment.

The bioassay test specified under federal regulations is a good monitoring test, which when applied properly, provides an indication of the deleterious effects of all toxic substances released from a pulp and paper manufacturing operation. The test also gives a rough indication of the sublethal and chronic effects of mill waste. However, the limits used in the test, and the test itself, are of concern to both industry and government administrators because of flaws which have become apparent with the passage of time. Industry's view of the federal toxicity standards is that the toxicity standards should be changed to take into account the concentration of toxic substance in the effluent being tested. As the amount of water used in processing declines, the lethal concentration in mill effluent rises. Therefore, as water usage declines within the industry, it can be anticipated that a higher incident of test failure will occur. The toxicity standards, as currently specified under federal regulations discourages the conservation of water, and to a more limited extent energy. It also discourages the transition to the newer less water demanding processes that are thought to be less disruptive to the environment.

The concern among government administrators is that there is a low level of compliance with federal toxicity standards. Some suggest the across-the-board requirement for biological secondary treatment. There are some who claim that low rate biological treatment systems will eliminate toxicity and offset the testing problems, which result from higher effluent concentrations. There are mills, which can be pointed to as examples to support the claim that longer retention systems do compensate for higher toxic effluent concentration. However, it is not true that all existing mills with secondary biological treatment systems test non-toxic. It is not true that longer retention systems offset the problems associated with high toxicity concentration in the effluent from all mills.

The evidence gathered in preparation for this study suggests support for amending current federal toxicity requirements. Consistent with the federal regulations for the petroleum refining industry, some adjustment should be made to encourage water conservation and allow for the use of more water efficient pulping processes. Mills should be required to use local receiving waters in toxicity tests to offset the problems associated with varying levels of pH. EP should encourage the use of a standard test among and between environmental agencies in Canada. If at all possible, any amendments to the regulations should be set in such way, so as not to relax the standards set in 1971.

There appears to be a tendency to underestimate the toxicity reductions which have been achieved by industry, because of the difficulties many mills appear to have had in reducing toxicity loadings to the levels specified in federal standards. The compliance performance of the industry, as viewed by government administrators and recorded in this report, does not take into account the lower water usage since 1971. It is based on total flow or water usage and on the pass/fail designation as determined in the test. The calculations are a valid measure of the total effluent discharge deemed to be acutely toxic, but they are not a valid indication of the degree of toxicity. Most mills in Canada probably have reduced water flow and the amount of toxic substances in their effluent over the years since 1971. If the industry were operating using the same amount of water that was used back in 1971, it could be expected that compliance with existing regulations would be much higher than indicated in this report. In fact, it appears as if the industry has made major progress in reducing its total toxicity over the last sixteen years. This is not generally recognised by environmental observers or government officials, because no allowance has been made for reduced water usage.

Chlorinated resin acids are found in bleach kraft mill waste. Chlorophenols are known to be present in sublethal concentrations in receiving waters near bleach pulp mills. Organochlorines are found in bleach kraft mills waste. These substances are known to be persistent and bioaccumulative. It is suspected that only a small portion of these substances have been discovered. Although the problems associated with small amounts of these substances may be overstated, it is recommended that efforts be undertaken to require industry to adopt mechanisms to remove organochlorines at the source. Reasons for this recommendation are as follows:

(1) As witnessed by the recent highly publicised situation with dioxins, there is a great and growing public concern about these substances.

(2) The source of organochlorines in a pulp mill is known with reasonable certainty.

(3) Organochlorines are persistent substances that enter the food chain through fish or their prey, and are therefore, a federal concern.

(4) Organochlorines are a potentially serious transboundary problem that is both national and international in scope, which could have trade implications without federal intervention.

(5) Organochlorines are becoming the focus of concern in a growing number of countries throughout the world.

(6) It is a complex problem of major proportions which will require substantial resources over many years if it is to be fully understood and controlled. As such, it is a problem that appears to require a commitment from the provinces and the Federal Government to satisfactorily address.

(7) There exists proven technology to control organochlorines reasonably efficiently. Chlorine dioxide substitution can reduce organochlorines by up to 50 percent. Oxygen delignification can reduce organochlorines and colour by around 50 percent.

(8) It has been estimated that there are potential cost of production savings as a result of using oxygen delignification. High chlorine dioxide substitution is considered an economically attractive method to reduce organochlorines. The higher the chemical costs, the greater the potential savings that can result from oxygen delignification. The overall chemical costs have been estimated to be unaffected by chlorine dioxide substitution of up to 50 percent for most mills in Ontario.

(9) Organochlorines represent a problem, which in the opinion of

some, is of such major importance that it surpasses the toxicity problems associated with resins and fatty acids.

A number of practical considerations indicate a need to place greater emphasis on international activities, as they relate to pollution control within the pulp and paper industry. The industry has for many years been a major economic activity internationally. Canada is one of the world's largest producer of pulp and paper products. The international appreciation for the need to control pollution has increased substantially in the years since the regulations were first introduced. It has been observed that the number of national environmental agencies involved in protecting the environment had grown to 113 in 1986. There appears to be a growing interest among industry and provincial agencies spokespersons for EP to monitor trends in pollution control technology both nationally and internationally. Consensus amongst industry and provincial environmental spokespersons is that EP should take an active role in encouraging consistent environmental controls across Canada. There is also support for maintaining consistent, but not necessarily the same, standards between Canada and the United States. The trend internationally, is to recognise pollution control efforts of each country as being an item in which all other countries have legitimate interest. This is particularly so when countries share common boundaries, or when the pollution from one nation impact on the environmental quality of another.

The information presented in this Chapter indicates that Canada, with comparatively limited resources, is not necessarily lagging behind the

United States in controlling effluent discharges from the pulp and paper industry. It would seem that the across-the-board requirement for secondary treatment has not necessarily resulted in appreciably large differences in environmental performance. Although, the United States industry does appear to be in a good position to deal more effectively and efficiently (at less cost) with pollution problems into the 1990's than is likely to be the case in Canada. The selective use of biological treatment appears justified, when circumstances dictate. There are many mills in Canada where further loadings reductions cannot be achieved unless secondary treatments are installed. Mills in the United States have been able to install biological treatment systems, which similar sized mills in Canada claim they cannot afford. The declining percentage of total capital expenditures being allocated to pollution controls by the industry in the United States appears to confirm an observation made earlier in Chapter Two, that the use of external treatments results in reducing the long-term costs of pollution controls for mills obligated to decrease discharges consistently within a clearly established period of time. The selective use of biological impact assessments to justify variances is being used in the United States, and industry appears to be able to absorb the shared costs of this work. The complicated system of controls which has been developed in the United States is not necessary in Canada, to protect the environment and should be avoided.

On the basis of the information and assessment presented in this Chapter, it would appear fairly safe to conclude that the Swedish government will continue to concentrate on eliminating chlorinated organic discharges in future. It also would appear safe to conclude that the Finnish government will place more emphasis on controlling chlorinated organic substances in future. Both countries appear to be committed to biological impact assessment, although with different emphasis. The Finnish government with its early focus on biological treatment appears to be in a good position to encourage the use of internal processes which are known to reduce chlorinated organics. The Swedish government will continue to press for internal controls, but in recognition of the value of external treatment in eliminating chlorinated phenolic substances, probably will encourage the use of both internal and external control measures. If the pulp and paper industry in Finland and Sweden in fact can be considered industry leaders in worldwide technology, it would appear that the future lies in controlling organochlorines.

Although the use of the Fisheries Act, as the legislative basis for enforcing industry effluent regulations, poses some problems to the officials responsible for enforcement, it allows for a regulative approach that is both efficient and effective when compared to alternatives. The general provisions under Section 33 of the Fisheries Act, which defines harmful discharges (including toxicity), on the basis of impact on fish is appropriate to federal jurisdictional responsibilities. It provides sufficient latitude to deal with the unpredictable consequences, which can result from discovering new harmful substances. It facilitates better coordination between and among environmental agencies in Canada. It is particularly important in ensuring a cooperative and consistent approach between federal agencies, which share responsibility for protecting the nation's waterways from environmental consequences of effluent discharges.

The intention in this recommendation is not to suggest that additional legislation cannot, or should not, be used to supplement or reinforce federal efforts to control pollution from the pulp and paper industry. There may come a time when the use of the Fisheries Act becomes inappropriate or even redundant. The position put forth in this Chapter is that the Fisheries Act has been used successfully by EP for controlling waste discharges from the industry. The pulp and paper industry is a complex and complicated industry which discharges a range of both known and unknown substances. The Fisheries Act provides sufficient latitude to deal with these complexities without having to absorb the expense and cost of testing and establishing protocols for potentially hundreds of substances. It should be maintained as a primary legislative basis for regulating the industry, until such time that some other legislative mechanism is proven to be at least as effective as the regulations that have been established under the Fisheries Act.

CHAPTER SIX

THE ECONOMIC AND SOCIAL IMPLICATIONS OF GOVERNMENT POLLUTION CONTROL REGULATIONS AND THEIR IMPACT ON INDUSTRY

The purpose of this Chapter is to provide an overview of the pulp and paper industry with the intention of defining the economic and social trade-offs involved in government intervention. The economic strength of the industry is reviewed. The economic impact of complying with government effluent abatement control standards is examined from an industry perspective. The need for government assistance programs is assessed. Cyclical trends within industry and the current negotiating patterns of government are examined and reviewed in terms of their implication on reducing effluent discharges from industry. The regulative approach adopted by the government is assessed on the basis of economic, social, and administrative feasibility.

The Need for Government Intervention

In Chapter Two it was pointed out that the obligation of industry to its shareholders is paramount. It is an obligation that benefits all Canadians through the creation of income, employment, and wealth. This is as it should be in a free competitive society. However, there is a responsibility that industry shares with all elements in society to protect the environment. In many cases, industry and the public share a common concern for safeguarding the environment. Unfortunately, the economic incentives are not always conducive to protecting the environment. Neither industry nor individual citizens necessarily provide a level of environmental protection appropriate to the needs of Canadians without some form of government intervention. Consistent with the information and discussion presented in earlier parts of this report, the need for such intervention is well documented. For example, it has been stated:

> Uncontrolled markets not only produce too much pollution, but they also tend to underprice commodities that contribute to pollution either when produced or when consumed. Firms which unilaterally attempt to control their pollution run the risk of pricing themselves out of the market. The government is needed to ensure that firms which neglect environmental damage in their operations do not thereby gain a competitive edge.[1]

While the economic and social reasons for government intervention are compelling, the approaches used, and the options available are numerous.

The Circumstances that Give Rise to the Need for Government Intervention

The commonly accepted conditions for government intervention in a free society are based on economic principles, which are meant to serve the interests of society. Such circumstances exist when: (1) certain elements of society are able to exact a disproportionately high price from individuals for goods and services, which would not otherwise accrue to those providing the goods and services under less than ideal competitive market conditions, (2) the rewards available under competitive conditions are not sufficient to induce the provision of goods and services which are considered socially desirable, and (3) the resulting benefits and costs of certain activities are not distributed in a manner which encourages responsible social behaviour. The fact that all three influence public administration in Canada is revealed by government activities. The existence of circumstances pertaining to (1) above have resulted in legislation to prevent price fixing, mergers or monopoly, and unfair trade practices. Circumstances which relate to (2) have resulted in government providing health care, education, national defence, police protection, and operating large utilities. Government activities that relate to (3) are the most complex, diverse, and widespread area of government intervention. It includes everything from municipal bylaws preventing people from smoking in public to the management of common property resources, and to pollution control.

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[1] Tom Tietenberg, Environmental and Natural Resource Economics, Scott, Foresman and Company, Glenview Illinois, 1984, p.456.

When government efforts to encourage responsible behaviour are examined in context of government pollution control activities, the need for these activities become obvious. Under the commonly accepted principles of operating a business in free society, a firm or mill pays the total costs associated with producing products offered for sale in market. If the price received from the purchaser of a product exceeds the total cost of producing and marketing that product, then the firm or business makes a profit. If the price received is less than the price of producing and marketing the product, the firm or business loses money. Society pays for the collective services provided by government, such as national defence, fire protection, water supply, and the cost of sewage disposal through taxation. When the total cost of producing a product is understood and appreciated by its producers, and included in the final price of the goods produced, all society is better-off. Society is better-off because the personal preferences or the needs of consumers are reflected in the marketplace by the price they are willing to pay for the final product.

Unfortunately, not all costs are fully known by society or necessarily understood or appreciated by producers. Environmentally disruptive waste discharges from a manufacturing operation are seldom reflected in the cost of production or in the price paid by consumers. Thus, the two principal beneficiaries from market transactions involving the sale and purchase of environmentally disruptive products are those selling and purchasing these products. They are benefitting as a result of the costs they are imposing on society in the form of pollution. As suggested above, the ideal solution would be to incorporate the cost of eliminating pollution into the final products so that those who benefit from the production of environmentally disruptive products, pay for the cost of pollution at no public expense. To some degree, the imposition of pollution control standards and regulations on industry "internalise" the cost of producing manufacturing products so that consumers share in the cost of pollution. If both industry and the consumers of products that industry produces paid the full cost for their pollution, and it was technically feasible to control pollution, then presumably the pollution caused by industry would be eliminated.

It is not technically or economically feasible to control all pollution from pulp and paper manufacturing. As a result in most countries society accepts some of the costs which come from the industry in the form of pollution in exchange for the benefits (jobs, income, and wealth) industry provides. What is difficult to determine is how much pollution society is willing to accept in return for the benefits provided by industry. Spokespersons for the pulp and paper industry point to the number of employees working in the industry, the importance of the industry to the local, provincial, or national tax base, and to the foreign exchange earned by their products when sold in world markets. These are cited as reasons for keeping pollution control requirements to a minimum. Those concerned about pollution from industry usually point out the negative effects of pollution problems and either argue that industry can afford to make the necessary changes to their production processes to eliminate or control pollution, or indicate a willingness to forego the benefits provided by industry. In all of this, there is substantial room for trade-offs, and governments often are left with the responsibility of determining precisely the point at which such trade-offs are appropriate to protect the interests of society.

Part of the complication for government is the fact that the amount of pollution that members of society are willing to accept in return for jobs and income varies quite considerably among individuals. Some argue that anyone discharging into the natural environment is making use of the assimilative capacity which is a publicly owned common property resource. They argue that the private use of publicly owned resources entitles citizens to receive full compensation in return for the use of their resources (this argument could be extended to include timber and water). This argument supports either immediately achieving zero discharge, or the imposition of a fee based on the level of discharge which would make waste discharges prohibitively expensive. Others point to the fact that the pulp and paper industry has used the natural assimilative capacity for a long period of time, thereby having established the proprietary historical right to the use of assimilative capacity. This argument supports subsidies to defray the costs of pollution abatement controls. Somewhere in between these two extremes, there are those who claim that the costs of pollution controls should be passed on to consumers so as to discourage the use of products and services which result in environmental damage. Advocates of this position argue that the use of economic incentives to discourage the use of environmentally damaging products and services through a tax on pollution also would result in providing government with additional sources of revenue.

Depending on which of the foregoing arguments government leaders are willing to accept, the approach used to control pollution from the pulp and paper industry can take any of a number of different forms. This is reflected in the various approaches used by different nations throughout the world. In some Eastern European countries, the use of discharge effluent fees play a prominent role in pollution control.[2] Czechoslovakia uses a basic charge on TSS and BOD with a surcharge ranging up to 100 percent, depending on the individual contribution to overall pollution concentrations.[3] Hungary and East Germany use a charge system in combination with effluent standards. France charges on the basis of the amount of discharge caused by the equivalent size of population and according to zone where the discharges occur. The Netherlands use a similar system.[4] West Germany uses a fee structure based on the amount of effluents discharged. It has been estimated that the fee structure in Germany would range up to $1 million per year for a discharge equivalent to the loadings caused by one small mill in Canada.[5] The number and variety of approaches used by the different countries and jurisdictions throughout the world clearly indicates that the governments of many nations have found it necessary to firmly intervene to control industrial pollution. The approaches used vary according to the economic conditions within particular nations, the competitive conditions in which the industry operates, and the social economic importance that society places on controlling pollution from industry. It appears that economic incentives are used to encourage responsible environmental behaviour in both Eastern bloc countries as well as in the West. There is little doubt that the importance that a society places on controlling pollution varies directly with what is perceived to be the natural assimilative capacity of the receiving environment, and not with the political philosophy of government.

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[2] Frederick R. Anderson, et al., Environmental Improvement Through Economic Incentives, The John Hopkins University Press for Resources for the Future, Baltimore, 1977, pp.59-67.

[3] Tietenberg, op. cit., p.361.

Concern About the Affects of Pollution Control Standards on Industry

The Canadian pulp and paper industry generates what are unquestionably very significant benefits for Canadians. It is the generation of these benefits which is the reason why the pulp and paper effluent abatement regulations are administered in a way which takes into account the social and economic welfare of those dependent on the industry for a living. It is the reason why existing federal regulations were established using a tiered system of enforcement. It is one of the reasons that provincial and municipal authorities might be willing to accept waste discharge levels in excess of the standards specified in federal regulations.[6] This is in turn one of the reasons that federal participation in regulating the industry is needed to ensure that residents living in all parts of Canada share equally in the opportunity to benefit from the industry without long-term deterioration in the global and national environment. However, the benefits from the industry are not provided without cost. They are not provided without considerable support by government.

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[4] Gardner Brown Jr., "Charge and Subsidy Programs of Several European Countries", The Practical Application of Economic Incentives to the Control of Pollution, ed. James B. Stephenson, University of British Columbia Press, Vancouver, 1977, pp.416-417.

[5] Norman Bonsor, Neil McCubbin, John B. Sprague, Stopping Water Pollution At Its Source: Kraft Mills Effluents in Ontario, report prepared by Expert Committee on Kraft Mill Toxicity for the Technical Advisory Committee, Pulp and Paper Sector of MISA, Ontario Ministry of the Environment, Toronto, April 1988, pp.1-12 and 1-13.

As noted elsewhere in this report, the industry's existence is based on the use of publicly owned resources. Pulp and paper manufacturers use about 35 percent of the nation's total annual forest production.[7] The industry is the largest user of water[8] and the second highest industrial user of energy.[9] The industry pays royalties and fees for the use of these resources (as do other industrial users), but over the five year period 1984 to 1989, the provincial and federal governments will be spending about $1.09 billion upgrading the nation's forests. The pulp and paper industry pays the lowest marginal tax rate in Canadian manufacturing.[10] It is not a government dependent industry, but neither does government place a very onerous burden on the industry in terms of the benefits the industry receives.

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[6] Recovery from the most recent downturn in the Canadian economy has been slow in most regions. This becomes most readily apparent when the economic progress in the western and eastern provinces are compared with Ontario. Throughout the whole of this slow and fragile recovery period, the pulp and paper industry has been the mainstay of the economy in many areas and regions. Understandably, these regions are justifiably protective of those manufacturers which are critically important to the well-being of their resident populations. Glen Bohn, "Pollution Charges Rile Quesnel Mayor", The Vancouver Sun, January 30 1987, p.A2.

[7] Economic Forestry Statistics 1986, Economic Report, Canadian Forestry Service, Pacific Forestry Center, Victoria, 1986, p.9.

[8] P.H. Pearse, F. Butland, J.W. MacLaren, Currents of Change, Final Report Enquiry on Federal Water Policy, Environment Canada, September 1985, p.39.

The overwhelming importance of the industry, convincingly underlines the need to both tailor pollution control regulations to the economic circumstances of the industry, and the environmental needs of Canadians. However, regulations no matter how necessary or desirable, practically always result in some members of society enjoying higher benefits than others. Restrictions on the activities of some, to benefit the larger society, require the establishment of criteria or basic principles to ensure that the regulations are not unduly restrictive, and include within them sufficient flexibility so as not to violate what would be acknowledged as fair. Therefore, much depends on how well those administering the regulations understand the basic principles under which the regulations are to be administered. Whether or not the administrative approach used is appropriate to the circumstances of industry and society, depends on the collective understanding of those responsible for enforcement.

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[9] A.J. Ewing, Energy Efficiency in the Pulp and Paper Industry with Emphasis on Developing Countries, World Bank Technical Report, No. 34, Washington D.C., February 1985.

[10] Two recent studies on the taxes paid by the pulp and paper industry have been undertaken. One was prepared under the auspices of the Economic Council of Canada, and the other by the Conference Board of Canada. The first study indicates that the pulp and paper industry has the lowest marginal tax rate among Canadian manufacturers. The second study suggests that the Canadian tax system places domestic pulp and paper companies at a competitive disadvantage with the U.S., Sweden, Finland, and Brazil. As observed by K.E.A. de Silva, one of the reasons for this apparent contradiction is that the Conference Board's study analysed only corporate taxes, whereas the study by the Council economists looked at all taxes paid by industry. See: T. Zolo, J. Warda, et al., Tax Competitiveness, The Canadian Newsprint Industry, Report 07-86H, The Conference Board of Canada, Industrial Business Centre, April 1986. M. Daly, et al., "A Manufacturing", Canadian Tax Journal, November/December 1985, pp.1155-1192. K.E.A. de Silva, Pulp and Paper Modernisation Grants: An Assessment, Economic Council of Canada, Discussion Paper No. 350, Ottawa, May 1988, p.6.

Those who administer the effluent pollution abatement regulations in Canada are required to enforce the standards in a way which prevents the establishment of pollution havens. They are required to take into account the economic conditions of industry, and the social-economic welfare of those who depend on a mill operation for a living. They also are required to enforce the regulations with a regard to the processes used, the technical capacity of a mill to achieve the necessary discharge reductions, and at the same time ensure even-handed enforcement across all components of the industry. In many respects, these are conflicting goals. It is seldom possible to achieve the necessary discharge reductions, and at the same time take into account all the undefined economic and social impacts that might occur, unless there is some mechanism for determining what is acceptable.

The level of waste discharge loadings allowed under federal standards is clear, if the complications associated with new, existing, altered, and expanded mills are ignored. Less clear is the economic and socially acceptable level of impact on industry. Certainly it would seem reasonable to expect that mill closure would be unacceptable under most circumstances. However, it is not clear whether declines in earnings, elimination of dividends, or slight reductions in employment are sufficient reasons for allowing a mill to exceed government standards. The dilemma faced by those enforcing the regulations is exacerbated by the fact that mill operators practically always claim economic hardship, when faced with the prospect of having to adopt additional environmental safeguards. Since industry only very infrequently has to justify claims about economic hardship, those administering the regulations often have little choice but to accept the unsubstantiated claims of detrimental effects that the additional expenditures associated with pollution controls will have on their manufacturing operations. As a result, it appears as if there has been a general tendency to overestimate the negative impact on the industry, as a result of having to adopt what are considered to be the necessary discharge reductions.

The Economic Strength of the Industry

Concern about the potential impact on mill operations has caused some to view the industry as economically fragile. However, even a very brief review of the economic circumstances of the industry reveals that Canadian pulp and paper manufacturers are not balanced on the edge of economic devastation. The industry is comprised of large powerful companies and firms, which have considerable resources.[11] In fact, of the approximately 82 pulp and paper firms operating in Canada, fifteen are among the top 100 pulp and paper producers in the world.[12] Eleven of the Canadian owned pulp and paper companies are included in this top 100 group.[13] Four of the five largest pulp and paper producers in the world operate in Canada.[14]

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[11] It has been observed that "Canadian pulp and paper companies are not generally large by world standards". Even though this observation is limited to only Canadian owned companies, it would appear to understate the strength of companies within the industry. With more than three times the number of mills in the United States, pulp production in the U.S. is only twice that of Canada. Estimates on concentration of sales among the top four firms in the U.S. is less than that of the top largest in Canada. Another recent study indicates that "4 Groups of Firms Control B.C. Timber, Thesis Says", The Vancouver Sun, April 20 1988, p.E6. K.E.A. de Silva, op. cit., p.11 and p.12.

Tables 6:1 and 6:2 show the assets and sales of the top four and top eight enterprises over the period 1975 to 1984.[15] According to Table 6:1, eight enterprises control 57.3 percent of the total industry assets in 1984. The top four enterprises accounted for 38.5 percent of the industry's assets in that same year. Table 6:6 shows that the top eight sales enterprises accounted for 58.6 percent of industry's sales in 1984. The top four enterprises were responsible for 42.2 percent of the sales in 1984. The comparative importance of the industry leaders in assets and sales remained fairly constant over the entire period 1975 to 1984.

The strength of the major elements within the industry is made even more clear when examined on a company basis. As of January 1985, five companies owned 35 of the 149 mills operating within the industry. These five companies accounted for 24 percent of the total daily production of newsprint, 56 percent of marketable pulp and kraft paper production, and 12.5 percent of other pulp and paper products. Seven major companies, including Donohue and Domtar, accounted for 42 percent of the

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[12] "World Watch", Pulp and Paper Journal, Vol. 40, No. 9, November 1987, p.17.

[13] Pulp and Paper International, Vol. 27, No. 9, September 1984, p.54.

[14] Kimberley Noble, "U.S. Maverick Tops Ranking of Paper Producers", The Globe and Mail, October 1 1987, p.B9.

[15] An enterprise is defined in Appendix I.

TABLE 6:1

ASSETS OF TOP FOUR AND TOP EIGHT[1] PULP AND PAPER ENTERPRISES TO TOTAL INDUSTRY ASSETS 1975 TO 1984 (IN MILLIONS OF DOLLARS)

	Total Industry Assets	Assets of Top Four Enterprises	Percentage of Top Four To Total	Assets of Top Eight Enterprises	Percentage of Top Eight To Total
1975	9,487	3,409	35.9	4,765	50.2
1976	9,942	3,556	35.7	5,374	54.0
1977	10,821	3,732	34.5	5,604	51.8
1978	11,620	4,089	35.2	6,048	52.0
1979	13,078	4,742	36.3	7,132	54.5
1980	14,515	5,182	35.7	7,756	53.4
1981	17,619	7,022	39.8	10,220	58.0
1982	18,917	7,290	38.5	11,191	59.1
1983	19,363	7,462	38.5	11,246	58.1
1984	20,606	7,940	38.5	11,801	57.3

[1] Top four and top eight in terms of total sales within industry.

Source: Statistics Canada, Cansim data retrieval, 1987.

TABLE 6:2

SALES OF TOP FOUR[1] AND TOP EIGHT PULP[1] AND PAPER ENTERPRISES TO TOTAL INDUSTRY SALES 1975 TO 1984 (IN MILLIONS OF DOLLARS)

	Total Industry Sales	Sales of Top Four Enterprises	Percentage of Top Four To Total	Sales of Top Eight Enterprises	Percentage of Top Eight To Total
1975	6,196	2,498	40.3	3,453	55.7
1976	7,302	2,961	40.5	4,096	56.1
1977	8,377	3,344	39.9	4,705	56.2
1978	9,850	4,277	43.4	5,737	58.2
1979	12,840	5,481	42.7	7,598	59.2
1980	13,094	4,694	35.8	7,062	53.9
1981	14,500	6,401	44.1	8,509	58.7
1982	13,442	5,916	44.0	7,924	59.0
1983	14,675	6,337	43.2	8,606	58.6
1984	16,953	7,157	42.2	9,941	58.6

[1] Top four and top eight in terms of total sales within industry.

Source: Statistics Canada, Cansim data retrieval, 1986.

average daily production of the industry in 1985 and 63 percent of the marketable pulp and kraft paper production.

The presence of large and powerful companies in the industry does not necessarily mean that every company and mill in the industry can achieve, the same level of effluent reductions with equal ease. Neither does it mean that larger companies will always be in a position to adopt environmental safeguards during every phase of the business cycle. The industry does experience periods when the imposition of environmental controls can place a substantial burden on company resources. There are many small firms that find it difficult to match the environmental control efforts of the larger companies. However, just as the existence of large and powerful does not mean that all mills are in a position to adopt the necessary environmental controls at a given point in time, neither does the existence of small firms necessarily imply that individual companies are unable to achieve loadings reductions commensurate with the standards specified under federal effluent abatement regulations.

Defining the Limits for Optimising Trade-offs Between Economic Prosperity and Environmental Protection

Although it is impossible to define precisely how much pollution society is willing to accept in return for the benefits provided by industry, the principles established when the federal effluent control standards were adopted implicitly define the range over which such controls should be administered. Federal discharge control standards provide

Canadians living in all regions with some minimum level of environmental protection. If the requirements are overly stringent, then the cost to industry will be high and losses of jobs and income will occur because of deterioration in international competitiveness. If environmental control requirements are overly lenient, then there will be unnecessary degradation of the environment. To the degree Canada's environmental laws are less stringent than similar laws in those countries importing Canadian produced pulp and paper products, Canada will be subsidising other nations by accepting pollution levels not tolerated in customer nations.[16] Insofar as individual regions choose not to maintain discharge control standards consistent with the national norm, there is a possibility for these regions to become pollution havens within Canada, and at the same time attract pollution from other nations. It follows therefore, that even though discharge limits should not be set and enforced in a way which weakens the pulp and paper industry's competitive position in world markets, neither should federal standards be set lower than other competitor nations, unless Canadians are prepared to accept the pollution problems of these nations in order to protect marginal manufacturers which cannot otherwise compete internationally.

As a general rule, an efficiently operated mill has lower discharges per tonne, and is in a better position to make the necessary investments on pollution controls, than its inefficient counterparts.[17] In the North American market, the difference between a low cost production mill and a high cost production pulp mill is $180 per tonne.[18] Thus, the general tendency to overestimate the negative impact on industry, because of having to adopt the necessary environmental controls, inevitably results in enforcement procedures which benefit the less efficient mills. Under such circumstances, government is in effect subsidising the inefficient operator at the expense of those who are efficient. Not only does this discourage the efficient mill from adopting the necessary environmental safeguards, because of what they might consider a penalty for being efficient (and perhaps large), but also encourages the inefficient allocation of capital and resources within the economy. It discourages improvements in factor productivity, and poses a long-term threat to the international competitiveness of the industry. Environmenmtal regulations should not be enforced on the basis of the least efficient operations.

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[16] The reader should note that Japan's tremendous push for economic independence and prosperity following the Second World War resulted in substantial environmental degradation. Japan is far less willing to accept pollution from industry today (although industry discharge standards have not changed since the early 1970's), than they were during those years when they were seeking to establish Japanese products in international markets. Japan's current emphasis is on high-tech manufacturing, which is not only less environmentally disruptive but generates greater income through the production of higher value added products. Japan is perfectly willing to import products which can not be produced without causing harm to the environment. In other words, Japan is willing to export its pollution to those countries willing to accept environmental degradation in exchange for unrestrained economic growth.

Cost of Having to Meet Federal Effluent Standards and the Potential Impact on Industry

Over the years there have been numerous studies undertaken throughout the world to determine the economic implications of reducing effluent discharges from pulp and paper manufacturers. Some of these studies examined the total cost of having to meet preset (and often very stringent) requirements within a particular time-frame.[19] Some have assessed the economic costs of having to install specific control measures.[20] Others have examined the overall aggregate costs of achieving particular reduction levels on a mill by mill basis using very broad technical assumptions.[21] Still others have examined the costs for individual mills or categories of mill operations.[22] All of these studies have been of value, because they have provided an appreciation of the costs facing industry. However, except for the most recent study by the MISA Expert Committee in Ontario, most have used industry averages to develop cost estimates. As a result, those undertaking these assessments have either overestimated the impact on industry,[23] or claimed that mill by mill information is required to assess overall impact.[24] While not denying the need for individual mill information to determine the financial consequences for specific mills, it would appear that most analysts have been far too reluctant to use the information available to provide the type of analysis necessary to guide the enforcement efforts of government.

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[17] Peter A. Victor, Terrence N. Burrell, et al., Environmental Protection Regulations Water Pollution, and the Pulp and Paper Industry, Economic Council of Canada, Technical Report No. 14, August 1981, p.78.

[18] Jaak Puusepp, Western Commentary, Pemberton Securities, Vol. 14, No. 7, June 1988, p.17.

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[19] Arthur D. Little Inc., "Economic Impact of Anticipated Paper Industry Pollution Abatement Costs", Paper Trade Journal, May 1972, pp.31-35. P.E. Wrist, "Potential Costs and Economic Impact of 1972 Clean Water Act", Paper Trade Journal, December 1973, pp.44-46.

[20] IEC Beak Consultants Ltd., Costs to Meet Pulp and Paper Effluent Regulations, prepared for Environment Canada, Ottawa, May 1985. The Action Plan for Marine Pollution, National Sweden Protection Board, Solva, Sweden, May 1987.

[21] Peter A. Victor, *op. cit.* Meta Systems Inc., Economic Impact Analysis of Proposed Effluent Limitations and Standards for the Deink Subcategory in the Pulp, Paperboard Industry, prepared for the EPA, Washington D.C., October 1982.

[22] Norman Bonsor, *et al.*, *op. cit.* L.R. Galloway, E. Schmid, J.W. Lebidoff, "Oxygen Delignification as an Alternative to Biological Treatment: A Case Study", Pulp and Paper Canada, Vol. 88, No. 1, 1987, pp.26-30.

[23] As noted in the most recent study by the MISA Expert Committee in Ontario, the Arthur D.Little study greatly overestimated the cost to U.S. industry for having to meet the effluent guidelines proclaimed under the U.S. Clean Water Act of 1973. Norman Bonsor, *et al*., *op. cit*., p.12-207.

[24] Peter A. Victor, *et al*., *op. cit*., p.78.

There is a great deal of heterogeneity in the cost structure of the industry. General pronouncements on the ability of the industry to make expenditures on pollution controls will either under or overstate the situation for individual mills. However, when taken in aggregate, it is possible to determine whether or not the industry can afford to meet the pollution control standards specified by government. When the upper limits of pollution control expenditures are examined against the level of investment necessary to build a new facility or undertake major mill modifications, then it is possible to provide a fairly accurate perspective on the impact on new operations. When the expenditures necessary for existing mills to adopt the measures to control current discharges are assessed in terms of increases to the unit costs of production and the prices paid in the marketplace, it is possible to predict the affect of having to meet current standards on the economic viability of existing mill operations.

As noted elsewhere in this report, the cost of installing environmental control and treatment systems is lower, the sooner such controls are incorporated into the design and construction of new mills. The problems associated with installing similar control and treatment facilities in existing mills are both complex and can be very expensive as a result of the circumstances at an individual facility. Through the remainder of the 1980's and the 1990's, it can be expected that the vast majority of new mills will be built to produce either BCTMP, CTMP, or kraft pulps. Although TMP and the high yield sulphite processes can be expected to remain a factor within the industry for a number of years, the number of sulphite operations in Canada have declined by about half over the past fifteen years, and can be expected to decline even further in future. Thus, BCTMP, CTMP, and kraft appear to be the most appropriate processes for measuring the upper level costs associated with controlling effluent loadings from both new mills entering the industry and existing mills which will continue to operate into the future.[25]

A new 1,000 tonne per day kraft mill costs about $600 million. It will have a chemical recovery system as part of its ongoing operation, because of the cost of production savings inherent to such systems. Therefore, those responsible for building a new kraft mill facility, with an eye to the future and wanting to use the best available effluent control technologies, will install a primary clarifier, a biological aerated lagoon, and an oxygen delignification system. The oxygen delignification system would not be an added environmental expense, because in a new mill it would in fact represent a substitute of one technology for another. Thus, the total additional capital cost for installing the latest available effluent control technology in a moderate capacity kraft mill would be about $35 million or roughly 5.8 percent of the total capital cost of building a new facility.

A new BCTMP facility that produces 600 tonnes of pulp per day costs about $250 million. The same sized CTMP pulp producing facility costs about $200 million. When such facilities are built with a concern for the future and wanting to employ the latest known effluent control technologies, they would install a primary clarifier, and an aerated lagoon. The total cost for these additional environmental controls, not including the land, would normally not be greater than $23 million for the BCTMP facility. It usually would not be greater than $18 million for the CTMP plant. The upper level of the total cost for installing such facilities at the present time within the industry represents not more than 9.2 percent of the capital cost of constructing either of these two types of processing facilities.

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[25] Professional personnel from the following firms cooperated by providing the information used to develop the cost estimates provided in this section: H.A. Simons Ltd., Novatec Consultants Ltd., Nystrom, Lee, Kobayashi (NLK) Inc., Sandwell Swan Wooster Inc.

Although the cost estimates provided here on new greenfield operations could be exceeded under certain circumstances, it is also true that in most situations the cost would be somewhat less. When the total cost of installing the latest effluent control technologies are compared with total capital expenditure requirements, it can be seen that the proportion of total capital expenditures attributable to effluent controls would be less for a 600 tonne per day BCTMP or CTMP facility than the percentage of total capital investment actually made by the industry on water related pollution controls for seven of the fifteen years up to 1985.[26] The cost of installing the latest in effluent control technologies in a new 1,000 tonne per day kraft mill is less than the percentage of total capital investment made by the industry for water related pollution controls for thirteen of the most recent fifteen years ending in 1985.

Under present circumstances within the industry, 47 mills are out of compliance with federal TSS standards, and 26 are out of compliance for BOD. Although there are exceptions, most mills in the industry could achieve compliance for TSS and BOD with relatively minor reductions in the total discharge of these effluents. This is not necessarily true for acute toxicity. On the basis of the effluent toxicity reports submitted to regional environmental authorities, approximately 83 of Canada's 122 direct discharge mills would consistently fail to meet the federal acute toxicity test. Therefore, most mills which are currently out of compliance with federal abatement standards are out of compliance because of their acute toxicity loadings. Acute toxicity loadings not only pose the greatest environmental problem for the majority of mills in the industry, they also are the most challenging to control over time. Biological treatment systems do not always render a mill non-toxic. Much depends upon the type of biological system used, and on the effectiveness of the internal control measures which have been adopted. Nonetheless, secondary biological treatment is considered the most effective proven technology available for reducing the total of the harmful effluents from most pulp processing operations, and is usually the single most expensive effluent control measure adopted by mills within the industry.

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[26] This observation is based on investment information provided by the Canadian Pulp and Paper Association and total capital investment information available through Statistics Canada.

The technologies adopted by existing mills in the industry can vary quite considerably. The capital cost of constructing a biological treatment system also varies considerably among mills. There are some mills within the industry which do not have the space necessary to build a full-sized aerated lagoon system. Under such circumstances, they may choose to adopt an activated sludge system, which is both more expensive to construct and operate than an aerated lagoon. It would seem reasonable to assume that a mill will install an activated sludge system only in those situations where no other alternative is available. The installation of an oxygen delignification system can cost up to $20 million. However, depending on the capacity of the chemical recovery system and the efficiency of the brown stock washing system, the adoption of oxygen delignification can add to the overall cost by up to $100 million. Therefore, it has to be assumed that a mill will not install an oxygen delignification system unless their boilers can be boosted (e.g. through improved gas mixing) and the downtime associated with rebuilding a new recovery boiler does not represent an expenditure inconsistent with the capital expenditure program of the individual facility. It can be projected that the upper level cost of installing the latest in effluent control technology within a kraft mill can be approximated most appropriately on the basis of the installation of an aerated lagoon system. The capital cost of installing an aerated lagoon system in a 1,000 tonne per day kraft mill can range up to $30 million.

The additional costs associated with operating an aerated lagoon for a kraft mill has been estimated to be up to $3.25 per tonne in the United States.[27] In Canada, the cost of operating an aerated lagoon system for a 1,000 tonne per day kraft mill located in Ontario, when taking into account electrical power, maintenance, labour, and nutrients, was estimated to be $2.5 per tonne.[28] Others recently have estimated the operating cost for a kraft mill of similar size to be in the neighbourhood of $3.7 per tonne.[29] Therefore, it would seem reasonable to estimate, that most 1,000 tonne per day kraft mills in the industry could operate an aerated lagoon system for less than $4 per tonne. When the capital cost of $30 million is amortised over a ten year period, using an annual interest rate of ten percent, the total additional capital cost per tonne of output for a 1,000 tonne per day kraft mill operating 350 days per year is $9.90 per tonne. A deliberately very high estimate of the total per tonne cost of installing an aerated lagoon system, which does not take into account the cost of land or tax depreciation allowances, would be $13.90. This represents approximately 1.8 percent of the expected average price paid for a tonne of softwood kraft pulp in the United States market during 1988.[30]

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[27] Treatability Manual, Vol. I, Office of Research and Development, U.S. EPA, EPA-600/2-82-001a, Washington D.C., February 1983.

[28] Norman Bonsor, *et al.*, *op. cit.*, p.12-210.

[29] Information obtained from cost estimates for individual mills.

BCTMP and CTMP are new pulping processes, which have only recently been adopted. The uncertainties associated with these processes are substantial. Based on current knowledge, most existing BCTMP and CTMP mills would adopt one of two different approaches for controlling acute toxicity. Those responsible for designing a BCTMP or CTMP facility might choose to install an anaerobic treatment system and add a three day retention aerated polishing basin, or they might choose a large aerated lagoon system by itself. A single aerated treatment lagoon offers several advantages over the combined use of an anaerobic system and an aerated polishing basin. The single lagoon system requires a smaller capital investment, has a proven track record, and is considered reliable. Anaerobic treatment is an emerging technology, which has not yet been proven reliable over the long-term.[31] The combined use of anaerobic treatment and an aerated polishing lagoon systems also has some advantages. An anaerobic treatment system can be operated at a cost approaching zero, depending on methane gas recovery. When used in conjunction with a polishing lagoon, it requires less land than a full sized aerated lagoon system. Therefore, the highest total capital costs for installing an effluent control system in a BCTMP or CTMP mill can be estimated most appropriately on the basis of the combined use of anaerobics and a polishing lagoon. The highest operating costs are incurred using a full-scaled aerated lagoon system.

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[30] Canadian Paper Analyst, Westmount Quebec, December/January 1987/88, p.5.

[31] Many consulting engineers consider anaerobic treatment risky and will not recommend the use of such treatment over an aerated lagoon system, unless the circumstances at an individual facility precludes using a full-scale aerobic treatment. Eric Hall, Anaerobic Treatment for BOD and Toxicity Reduction in Pulp and Paper Wastes, Environment Canada, Wastewater Technology Centre, Burlington, April 1987.

The capital cost of installing an anaerobic system in conjunction with an aerated polishing lagoon for a 600 tonne per day BCTMP mill could approach up to $22 million. The operating costs for a full-sized anaerobic lagoon can range up to $4 per tonne.[32] When the capital cost of $22 million is amortised over a ten year period at an annual interest rate of ten percent per year for a 600 tonne per day BCTMP mill operating 350 days a year, the total additional cost per tonne for adding this technology amounts to $12.80 per tonne. Once again, this is a deliberately high estimate which does not take into account land costs or tax depreciation advantages. The average price paid for BCTMP pulp in the United States market during 1988 is expected to be about $560 per tonne. The total cost of installing the latest in available technology for controlling acute toxicity in a 600 tonne per day BCTMP or CTMP mill would not likely exceed 3.3 percent of the current price paid for BCTMP pulp in the United States market.

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[32] Douglas A. Fromson, William T. Chalmers, Donald R. Manolescu, Anaerobic$ Made Money Treating BCTMP Effluent, a paper presented at the Western Branch of CPPA Annual Conference, Jasper, Spring 1986. O. Sam Turk, Hal Hamilton, Conceptual Review of Alternative Waste Water Treatments for the CTMP Pulp Mill at Whitecourt, prepared for Alberta Environment, August 1987.

The impact of adding $14 per tonne to the total cost of producing pulp should not be underestimated, neither should it be overestimated. It can be argued that cost estimates, which are compared with current record high market pulp prices provide a distorted picture. This certainly would appear to be true, when such comparisons are used to assess the impact of cost of production increases on industry over a ten year period. However, it should be noted that as prices rise through time, the significance of a single fixed cost of production increase (assuming a constant interest rate) declines. Moreover, when a fixed increase of $14 per tonne is taken as a percentage of the 1983 cost per air dried tonne of production at the mill level, it would have represented 3.5 percent of total production cost among eastern mills, 3.8 percent among British Columbia interior mills, and 3.3 in British Columbia coastal mills.[33] This same comparison with 1986 production costs, indicates that a cost of production increase of $14.00 per air dried tonne would have represented 3.4 percent of mill level production costs among eastern mills, 3.9 percent among British Columbia interior mills, and 3.4 percent for British Columbia coastal mills.

The single highest factor input cost at the mill level in 1986 was wood fiber, followed by labour, then chemicals and energy. Depending on location, the cost of chemicals and energy together average roughly 23 percent of mill level production costs.[34] Energy costs have risen by as much as 31.6 percent and declined by as much as 11.8 percent for some mills over the four years 1983 to 1986. Chemical costs rose by 6.6 percent for British Columbia mills in 1983. Sharp fluctuations in factor input prices are not unusual in the industry.

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[33] The Market Pulp Industry 1983-1986, Forest Sector Advisory Council, Price Waterhouse, October 1987.

[34] The energy requirements of CTMP mill are roughly three times as much as for a similar sized kraft mill.

Fluctuations in foreign exchange rates can have an even more dramatic effect on final prices in the industry's major markets. The higher the Canadian dollar in terms of the United States dollar, the higher the purchase price of Canadian produced pulp to customers in the United States market. The accumulated change in the exchange rate between Canada and the United States was 12.7 percent between 1983 and 1986. Exchange rates also can have a traumatic effect on competitive prices in foreign markets. The lower the value of the Canadian dollar relative to the currencies of foreign competitors, the more attractive the competitive price for Canadian produced pulp. The value of the Finnish markka increased by 24 percent relative to the Canadian dollar between 1983 and 1986. The value of the Swedish krona increased by 21.1 percent relative to the Canadian dollar during that same time period. There is no doubt, that under certain circumstances, the increased costs associated with installing effluent discharge controls could have an impact on the competitiveness of individual mills and the industry. This is particularly true when market declines are accompanied with rising interest rates, a rise in the relative value of the Canadian dollar, energy price increases, a rise in labour costs, or chemical price increases. However, given the very marked changes in the exchange rates, energy cost increases, and shifts in chemical prices, the cost of installing the necessary effluent discharge controls cannot be considered threatening to the industry if sufficient lead time is allowed for industry to adopt controls.

Once again, it is emphasised that the effluent control and treatment cost estimates provided above are deliberately high. The Ontario MISA Expert Committee on Toxicity estimated that an existing 1,000 tonne per day kraft mill could install an aerated lagoon system at a capital cost ranging between $15 and $25 million.[35] The cost per tonne estimates used here were developed using a capital cost estimate of $30 million for the same size of kraft mill facility. However, not all mills produce 1,000 tonnes of kraft pulp per day or 600 tonnes per day of thermo-mechanical pulp. The unit cost increases which result from secondary treatments will be higher the smaller the mill production. It will be higher the more difficult it is to separate and collect effluents because of mill design or plant configuration. Space or site limitations also can add to the overall cost of installing a biological treatment system. Much depends on the circumstances at an individual mill. Nonetheless, the absolute size of these costs, and the capacity of a mill to absorb these unit cost of production increases, are greatly influenced by those operating the facility.

As previously noted above, the difference between a low cost production pulp mill and a high cost production mill in the North American market is more than $150 per tonne. It follows, therefore, that the capacity of a mill to absorb the unit production cost increases which result from installing secondary treatment depends to a very large degree on mill production efficiency. The higher the water usage and the greater the amount of effluent requiring treatment, the higher the cost of installing a treatment system. If a mill has not already adopted the mechanisms necessary to separate and collect effluents, then the cost of adopting such mechanisms adds directly to the expense of installing secondary treatment. Conversely, if internal control modifications have been made and water usage is low, the cost of installing secondary treatment will be correspondingly low. Biological secondary treatment is an incentive for reducing the amount of water used in process; it is an incentive for improving production efficiency; it is an incentive for adopting the best available internal control technologies. To the degree that the cost of installing secondary treatment at a mill surpasses what can be considered the norm for other mills with similar production capacity and pulping processes, these higher costs can be legitimately viewed as at least partially self-inflicted.

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[35] Norman Bonsor, et al., op. cit., p.12-210.

There are economic advantages to altering more than one process to increase output or to control discharges at the same time secondary treatment is added. For example, oxygen delignification can reduce organic waste by about 25 percent.[36] This can reduce the overall costs associated with installing an aerated lagoon system by about five to ten percent. Further, there are some net savings in variable costs that can be attributed to the introduction of oxygen delignification.[37] It has been estimated that oxygen delignification reduces operating costs by

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[36] Douglas W. Reeve, Paul F. Earl, Chlorinated Organic Compounds in Bleached Chemical Pulp and Paper Effluents: Part 1 The Potential for Effluent Regulations, Spring conference Canadian Pulp and Paper Association May 19-21 1988, Technical Section Pacific Coast and Western Branches, Department of Chemical Engineering and Applied Chemistry, University of Toronto, p.1.

[37] Ibid., p.12-211.

$11 to $12 per tonne for some softwood kraft pulp mills.[38] Similar cost savings possibilities could be cited for other pollution control systems implemented in conjunction with secondary treatment. However, in order to avoid such complexities, it suffices to say that practically all mills can reduce the long-term cost of environmental controls through the combined introduction of more than one processing system at the same time.

Capital Investment Patterns in the Industry and Expenditures on Environmental Controls

The costs of adopting the pollution control measures necessary to meet federal effluent standards do not represent trivial expenses to the pulp and paper industry. The costs associated with installing pollution control measures can place a burden on individual mills, particularly during periods when paper product sales are low and economic conditions are poor. However, the industry does not operate continuously under poor market conditions. If the total of the mills in the industry were to include environmental expenditures as part of their long-term planned capital investment programs, some of the difficulties associated with meeting government environmental standards could be eliminated, and the long-run costs of adopting the necessary controls could be reduced.

The financial advantages associated with long-term planned capital investment can be demonstrated using the hypothetical short-run cost curves presented in Figure 6:1. With dollar costs on the vertical axis and discharge reductions on the horizontal axis, this Figure shows technically and biologically determined short-run cost curves for the industry and individual mill process categories.[39] Curve I is assumed to depict the cost curve for the industry. Over the A portion of curve I to a point corresponding with the line distinguishing between A and B zones on the horizontal axis, discharges can be reduced at minimal cost to industry. In zone B, further loading reductions cannot be achieved without additional cost to industry. In zone C, the cost of each incremental reduction results in disproportionately high additional costs to industry. A shift from curve I to curve II, represents an improvement in pollution abatement technology that has already occurred and been implemented by some mills in the industry. As such, it shows that those mills which have implemented new existing technology by shifting to curve II can achieve discharge reductions greater than those depicted for every level of expenditure corresponding with zones B and C on the curves. The introduction of pollution control equipment which reduces factor input requirements (i.e. chemicals, energy etc.) or increases productivity would alter the curve from I to III.

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[38] It is estimated that the pre-treatment steps and effluent requirements for controlling TOCl to 1.5 kg per tonne would cost about 100 to 150 SEK per tonne of pulp produced for mills in Sweden. This is equivalent to an additional cost of between $20 to $30 per tonne Canadian. Action Plan for Marine Pollution, National Environmental Protection Board, ed. Ingvar Bingman, Solna Sweden, May 1987, pp.34-35.

As readily recognised by everyone involved in pulp and paper

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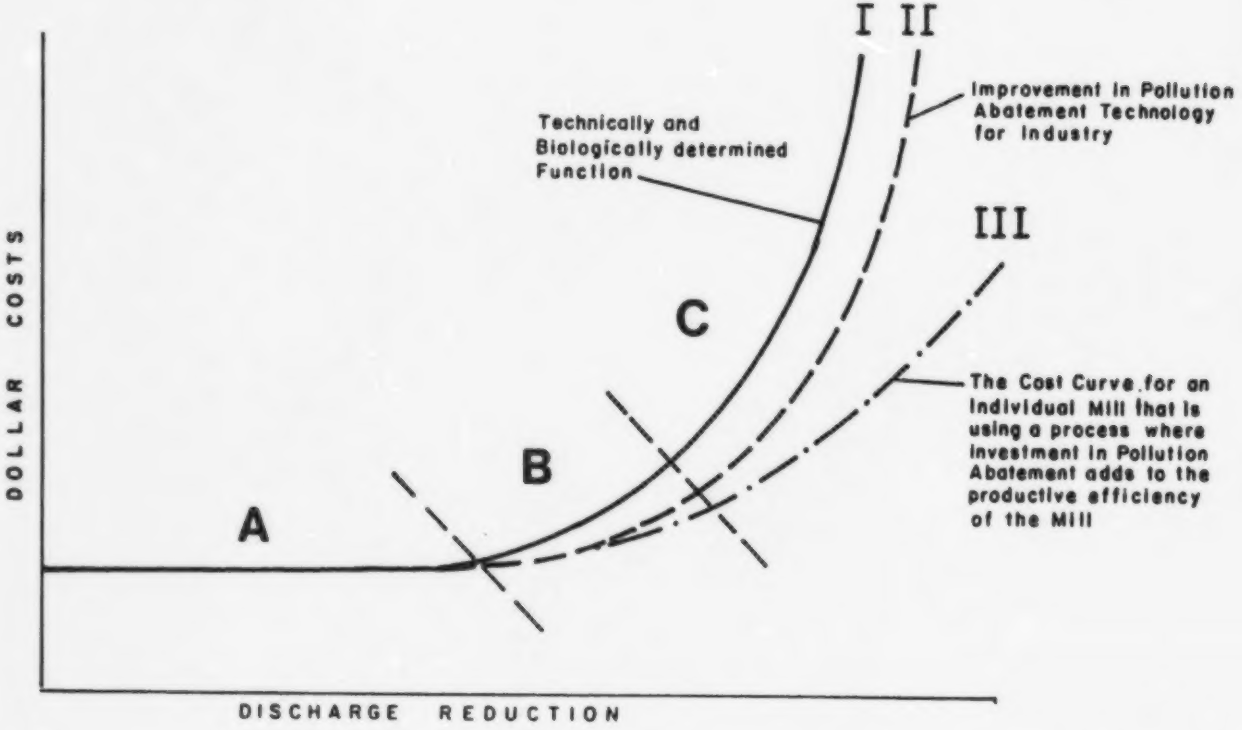
[39] The terms short-run and long-run have specific economic meanings which do not correspond to a fixed unit measurement of time. Even though fixed and variable inputs can vary somewhat according to circumstances, the short-run is that period of time over which a firm or mill cannot change the fixed factor inputs (usually plant and equipment), but it can change variable factor inputs (such as raw material and labour). The long-run is that period of time over which a firm or company can change all factor inputs. As the reader will recall, a mill under construction can install pollution control equipment cheaper than an existing mill. Therefore, as reaffirmed later in this presentation, the distinction between short-run and long-run is not an unimportant consideration, when assessing a mill's financial ability to invest in pollution control equipment.

FIGURE 6:1

INDUSTRY AND INDIVIDUAL MILL SHORT RUN COST CURVES FOR POLLUTION ABATEMENT


I
II
III
Improvement in Pollution Abatement Technology for Industry
Technically and Biologically determined Function
C
The Cost Curve for an Individual Mill that is using a process where investment in Pollution Abatement adds to the productive efficiency of the Mill
B
A
DOLLAR COSTS
DISCHARGE REDUCTION

A) Range is the area over which significant reductions in loadings can be achieved at minimal costs to industry.

B) Range is the area over which further loadings reductions can be made only when deliberate investment is made in pollution abatement reduction. The ability to absorb costs depends on the time the industry and individual mill is given to respond.

C) Range is the area over which further loadings reductions can be made only at substantially high investment by industry.

production in Canada, the economic costs of adopting pollution control measures varies with the type of pulping process used at a mill. Curves I and III in Figure 6:1 also can be used to show the essential nature of these differences. Assume curve III depicts the effluent discharge reductions cost curve facing kraft mills in the industry, and curve I is the corresponding curve for sulphite mills. Accordingly, kraft mills can achieve higher levels of loading reductions for every given level of expenditure (reading off the horizontal axis) beyond the line distinguishing between zones A and B. The point on the curve where economic considerations become an issue of financial concern to the industry is lower (in terms of reductions) for sulphite mills than it is for kraft mills. Consistent with the realities of the industry, these curves show that the ability of mills to adopt the necessary pollution control measures varies according to process (in this example between kraft and sulphite mills). However, there are a number of somewhat less apparent implications that can be drawn from this. These are: (1) The shape of the cost curve facing an individual mill (and all of industry) changes with changes in technology. (2) An individual mill can change the shape of the cost curve of its mill operation by adopting technologies which increase productivity or reduce factor input requirements. (3) It follows from (1) and (2) above, that a systematic approach which is designed to build on the loadings reductions achieved during previous periods decreases the economic impact of having to achieve a targeted level of loadings reductions at a particular point in time.

Although the example curves shown in Figure 6:1 are hypothetical, the curves do depict the economic realities of adopting pollution measures within the industry over the short-run. It is clear from these examples that over an identifiable range of loadings reductions, incremental improvements in environmental performance can be achieved at minimal cost to industry. The trade-off is not always between having mills consistently on the verge of bankruptcy and an environmentally clean industry, as some arguments put forth by industry spokespersons would suggest. Even in those situations where large capital investments are required, once such investments are made, further reductions almost always are possible with only relatively modest commitments of additional resources. Important here is the need to make a distinction between the long-run and the short-run. Over the short-run, some mills will not be able to make the necessary investments without disruptions to their operations, and will require more time. However, over the long-run, virtually all economically viable operations will be able to install the necessary safeguards. Much depends on the approach used by mills in the industry. The planned and phased introduction of new technologies in conjunction with the adoption of effluent control measures will substantially reduce the overall long-term costs of achieving targeted levels of reductions.

The overall implications of the information presented above is that investment patterns within industry play a very major role in determining both the progress made in reducing waste discharges and the resulting impact on industry. The general tendency within the industry has been to make very substantial capital investments on increasing production capacity during economic buoyant periods. Despite this, the information on investment patterns provided in Figures 6:2 and 6:3, reveals that industry makes comparatively low levels of investment on pollution controls during these same periods. Figure 6:2 is used to present a three-year running average on capital investment on pollution controls for air and water as a percentage of value added generated by the industry according to region over the period 1971 to 1984.[40] With the exception of Quebec, investment on controlling effluent discharges as a percentage of value added was lower for all regions during the early 1980's, than for any other three year period since the early 1970's. It appears that there is considerable variation in the proportion of returns committed to investment on pollution controls in every region. There does not appear to be a consistent and systematic planned approach for making investments on pollution controls among regional components of the industry. It would appear that the pulp and paper industry chooses not to invest in pollution controls, when the industry is in the best position to undertake such investments.

The observation that the industry does not choose to invest in pollution controls when economic conditions are favourable is confirmed by data presented in Figure 6:3, and by information provided by the Canadian Pulp and Paper Association for 1987.[41] Figure 6:3 provides information comparing the percentage of after tax profit on total income, the percentage cash earnings on sales, and the percentage of after tax profit

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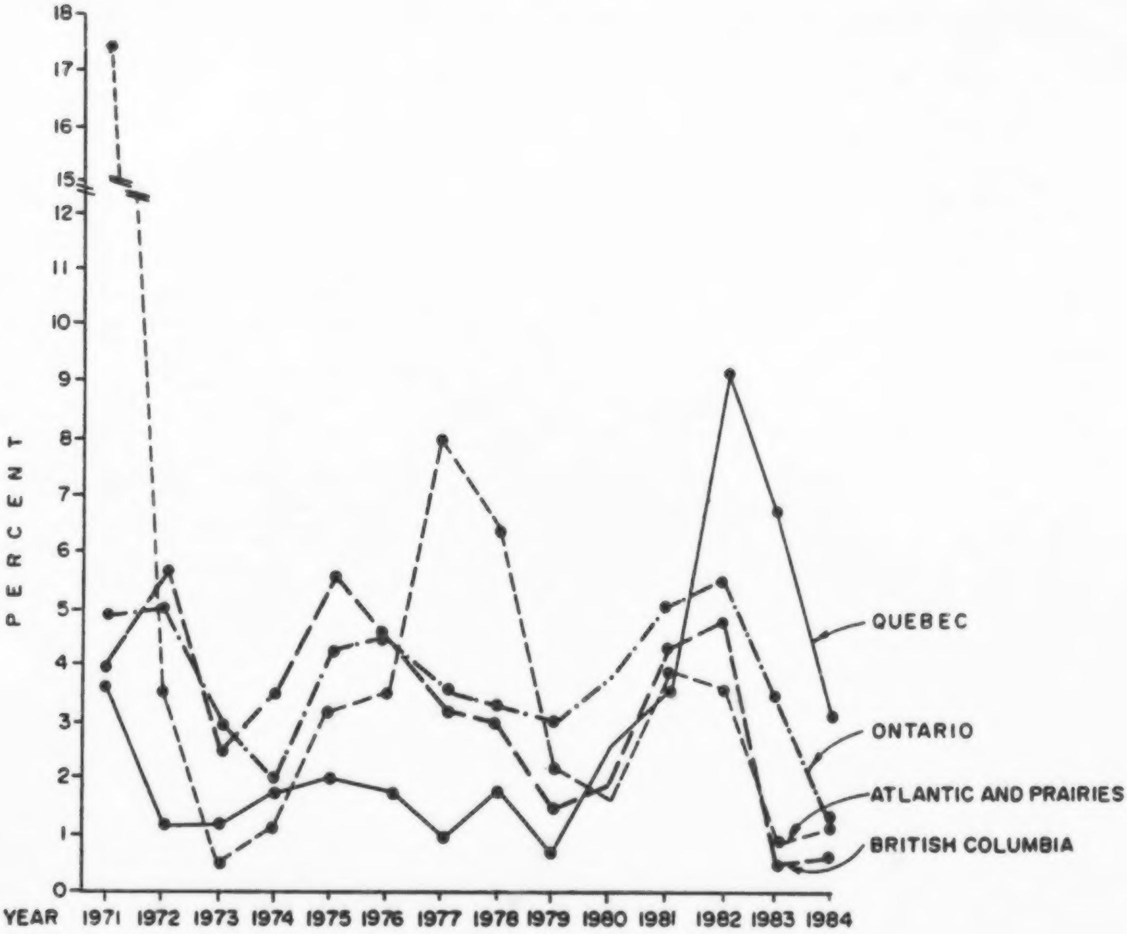
40 Once again the reader should note that the three-year running average is calculated using investment and value added information for 1970 and 1985 as well as for the years shown on the Figure.

41 Information provided by the Canadian Pulp and Paper Association in June of 1988.

FIGURE 6:2

CAPITAL INVESTMENT IN POLLUTION ABATEMENT FOR AIR AND WATER (THREE YEAR MOVING AVERAGE) AS A PERCENTAGE OF VALUE ADDED[1] GENERATED BY THE INDUSTRY ACCORDING TO REGION[2]
1971 TO 1984



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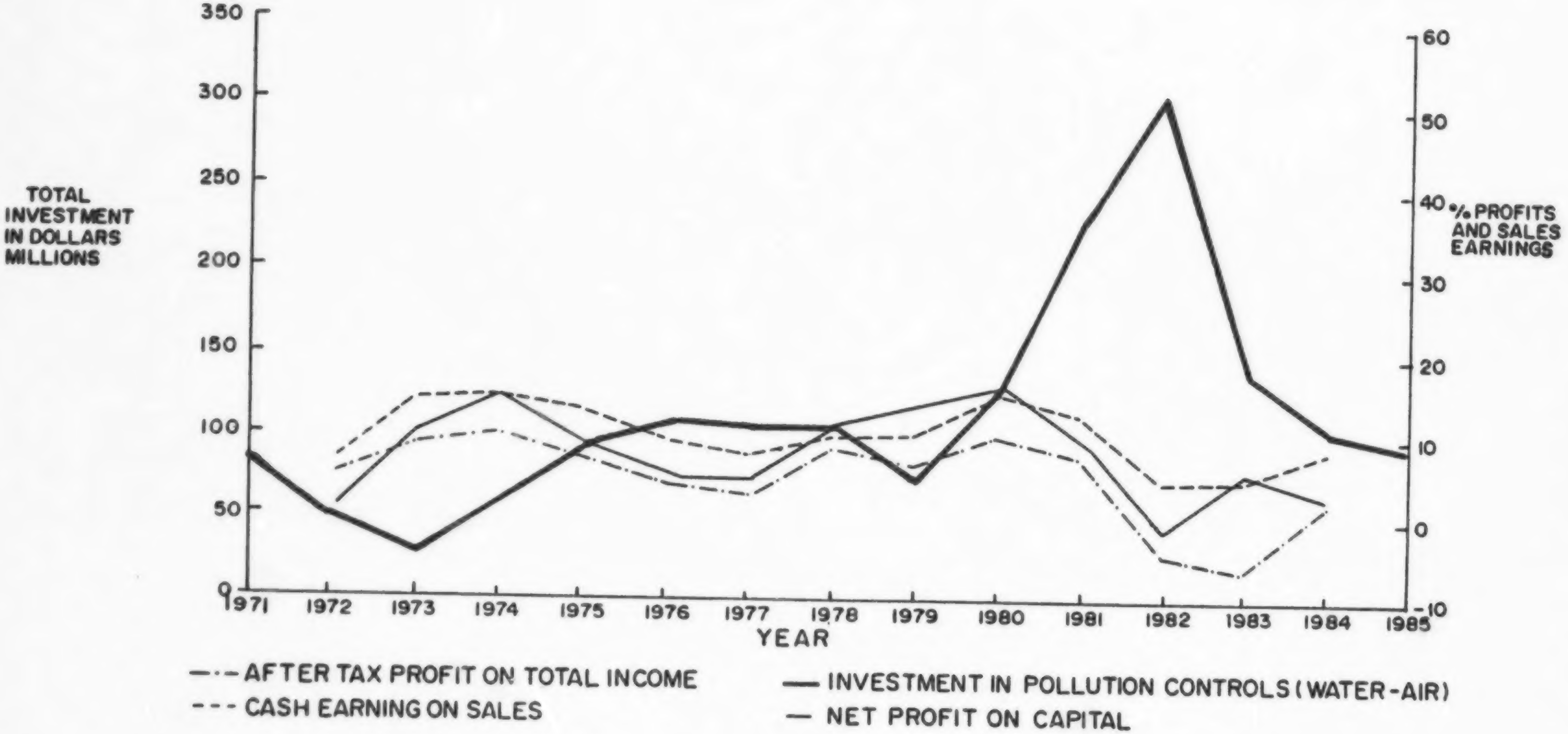
[1] Value added is the difference between the price paid to purchase raw materials or finished parts and the sale price of the product produced.

[2] Because of disclosure restrictions, Atlantic and Prairies are combined.

Source: Canadian Pulp and Paper Association of Canada.

FIGURE 6:3

THE PERCENTAGE OF AFTER TAX PROFIT ON TOTAL INCOME, CASH EARNINGS ON SALES, AND AFTER TAX PROFIT ON TOTAL CAPITAL COMPARED WITH TOTAL INVESTMENT ON POLLUTION CONTROLS FOR PULP AND PAPER INDUSTRY
1971 - 1985



Source: Statistics Canada, Catalogue 61:207 and Canadian Pulp and Paper Association Investment Information.

on capital with total investment on pollution controls by the pulp and paper industry for the years 1971 to 1985. According to the information in this Figure, investment on pollution controls varies inversely with economic conditions within the industry.[42] The information made available by the Canadian Pulp and Paper Association indicates that during the boom year of 1987, when many companies within the industry were enjoying historically high profits,[43] only five percent of the total estimated $2.5 billion capital investment by industry is expected to have been spent on pollution controls.[44] This represents the lowest percentage of total investment made on controlling waste discharges within the industry during the fifteen years since the federal effluent control regulations were first adopted.[45] It is apparent from this example and the information provided in Figures 6:2 and 6:3 that the pattern in the industry is to reduce expenditures on pollution controls during buoyant economic periods.

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[42] Regression coefficients developed through multiple linear regression analysis confirms the negative correlation between high economic returns within the industry and investment on pollution controls. These coefficients are not statistically significant. In order to provide a reliable indication of statistical significance, an increased number of observations would be required. The number of observations is limited by the amount of information that is available.

[43] Abitibi-Price, B.C. Forest, Canfor, Crestbrook, Cons-Bathurst, Crown Forest, Donohue, Great Lakes, and MacMillan Bloedel all earned record profits during 1987. Although record earnings were achieved by these and others companies in 1987, as noted in the Canadian Paper Analyst of February 1988, it appears that only MacMillan Bloedel set a record for return on shareholders' equity. This relates to the fact that the asset bases for the other companies increased faster than the growth in earnings during the year.

[44] One recent article indicated that the pulp and paper industry is maintaining its spending on pollution controls during current period of expansion. It is noted that the industry is expected to spend $159.1 million of total expenditure of $6 billion on pollution controls. This represents a total commitment of less than three percent on pollution abatement. "Pulp and Paper Mills Maintain High Level of Cleanup Spending", Eco/Log Week, Vol. 15, No. 35, September 4 1987, p.3.

[45] See Table 5:13, p.395, Chapter Five.

The tendency of the industry to spend large amounts of money on expanding capacity during buoyant economic periods, without making commensurate levels of investment on pollution controls, contributes to the difficulties of bringing the total of the industry into compliance with government regulations. It is difficult to conceive of even very large and efficient producers willingly making the necessary investment on pollution controls during poor economic periods, when they appear to be unwilling to make similar investments during buoyant times. The problem becomes even more serious for marginal producers during economic lows, because of increased competition due to expansion in capacity during the previous upswing. This pattern of expenditure not only demonstrates a lack of commitment by industry to meet government standards, but adds immeasurably to the perception that government environmental requirements contribute to the economic difficulties within the industry.

The right of industry to eliminate debt and add to productive capacity during buoyant economic periods cannot be questioned. Every company and firm has an obligation to generate profits and to position themselves to compete effectively in the marketplace. Every mill has to replace machinery as equipment wears out or becomes obsolete; every mill has to adopt new processing technology to remain competitive within the industry. Expenditures on pollution controls are not insignificant in terms of cost. Pollution control expenditures almost always result in low or negligible returns. Mills do not make such expenditures without diverting money from other, often very lucrative, investment alternatives. Thus, the incentive for industry is to delay expenditures on pollution controls in order to maximise return on financial assets. Directors on the boards of companies have to justify investment decisions to their stockholders, company executives have to justify their expenditures to boards of directors, and mill managers have to justify their expenditures to corporate executives. Mill managers are not likely to be in a position to justify expenditures on pollution controls, unless the environmental obligations are made clear under the law and the standards are enforced consistently across the industry.

It is difficult to overstate the importance of having firmly established rules, which apply to all mills within the industry. Companies cannot be expected to voluntarily adopt pollution control measures, which are disruptive to their ongoing operations and place them at a disadvantage with their competitors. Industry cannot be blamed for their apparent lack enthusiasm for meeting federal effluent standards when there is uncertainty with respect to government intention. Uncertainty with respect to government intention detracts from the planned and phased installation of environmental control systems. It adds to the cost of industry having to meet environmental controls over the long-term. It helps to foster capital expenditure patterns which are inconsistent with bringing the industry into compliance. It encourages individual mills to avoid adopting the necessary controls in order to achieve competitive advantage. The vast majority of mills in the industry would have little trouble in meeting government standards if the uncertainties associated with the enforcement of regulations were eliminated, and all of the industry had to meet the specified discharge limits at a realistically established preset point in time.

Effluent Control Costs and Economic Viability

To a very large degree, the economic problems attributed to the federal effluent abatement regulations are overstated and misunderstood. Industry officials and their representative organisations usually respond with considerable dismay at any suggestion of having to adopt additional enviromental safeguards. In some cases, it is claimed that enviromental safeguards will destroy the industry's competitive position in international markets. Individual companies indicate that their operations will become economically unviable and permanent closure will result.[46] Others contend that they will be unable to keep pace with other competitors in the domestic market, and their individual operations will suffer as a result. Still others claim that the jobs, income, and tax revenue provided by their operations should preclude them from having to make investments on pollution controls which threaten economic viability. These all encompassing arguments, which are based on broad economic assumptions of questionable validity, tend to distort the essential nature of the economic problems which can be attributed to federal effluent abatement regulations.

The need to control effluent discharges from the pulp and paper industry is not an unproven social need. The obvious advantage of having national standards which apply to all regions of the country suggests that federal involvement is required. Every developed nation in the world, which has a pulp and paper industry has national standards which are applied to their industry. The issue is not whether the industry should be required to reduce effluent loadings. It is not a question of whether individual mills should reduce loadings in tandem with mills located in other parts of Canada. The essential considerations are what levels of reductions are necessary to protect the overall interests of Canadians, and the time that should be allowed to achieve these reductions. The standards which have been set by the Federal Government are minimum standards, which mills in the industry could meet over the long-run without disruption to their ongoing operations. The burden placed on industry as a result of meeting these standards is greatly overestimated. The threat to the economic viability of individual mills is overstated. The potential impact on individual mills is misunderstood.

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[46] Sherri Aikenhead, "Showdown Over Pollution", MacLean's, February 2 1987, p.81.

Under competitive economic conditions (the conditions in which the pulp and paper industry competes in international markets) there are secular and cyclical fluctuations which inevitably result in economic hardship for mill operations. Over the long-term secular fluctuations occur when each mill acting independently adds to its productive capacity in response to demand increases due to growth in the population and the introduction of new technologies which require more paper or paper products (i.e. photocopying machines and computer printouts, etc.). As the capacity within the industry increases worldwide, supply will overtake demand so that there is an excess supply, and prices will start to decline. As prices decline, those mills which are inefficient or have not kept pace with technological changes in the industry, will find it difficult to compete and will either exit the industry or the owners will sell the mill and assets to competitors or others seeking to enter the industry. The weaker and inefficient operators give way to the more aggressive and competitive efficient operators for the general good.[47] This is not only healthy for industry,[48] but is a necessary ingredient for continued prosperity. It is a phenomenon which would continue over the long-term even in the absence of the highs and lows in the business cycle.

The long-term secular trends interact with cyclical fluctuations in business activities to accentuate peaks and troughs within the industry. Once again, each mill acting independently will respond to upturns in business activity and rising demand by increasing production. As production increases, some mills will make permanent additions to mill capacity. When the business cycle downturn occurs, some mills will be overextended and the result will be high debt and precarious economic circumstances. However, producers tend to resist suspending operations, because of the large costs associated with shutting down production lines and temporarily laying off employees in remote or isolated locations. The industry as a whole generally resorts to price discounting to maintain operations in anticipation of improved market conditions. These cyclical and secular cycles would occur even in the absence of government attempts to have industry reduce pollution.

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[47] The Economic Council of Canada has observed that the growing gap between the United States and Canadian manufacturing is because of the failure of Canadian firms to rationalise, thereby "improving their productivity". Reaching Outward, Economic Council of Canada, Twenty-Fourth Annual Review, Canadian Government Publishing Centre, Ottawa, p.31.

[48] This has been the experience in the pulp and paper industry in both Sweden and Finland. Thomas Nysten, President of the Finnish Paper Mills' Association (Finnpap) in response to consolidation within the Finnish industry observed that "in order to survive we have to become more productive". Wayne Karl, "The Finnish Report", Pulp and Paper Journal, Vol. 40, No. 8, October 1987, p.29.

The high capital cost and factor input requirements in the pulp and paper industry makes both exiting and entering the industry very difficult.[49] The ability of companies and firms to exit and enter also is limited by timber supply considerations. A firm seeking to enter the industry either has to purchase an existing mill operation and acquire the use of existing timber supply, or build a new mill and apply to provincial authorities to obtain the right to use forest lands not already committed to existing forest products operations. Those seeking to leave the industry will have to dispose of mill facilities and assets, which are only valuable when used as part of the pulp and paper industry. The existence of these assets normally precludes a firm from simply closing down. Even if the company or firm has recovered its sunken costs by allowing its mill to run-down, and likely become inefficient, this does not necessarily mean that a mill will permanently close. The assets will continue to have some, perhaps limited, value. The timber rights which are normally linked to mill operations are valuable. The mill assets and timber rights together usually prevent operators from abandoning a mill facility. As confirmed by the number of mills in the industry which have operated over many years, pulp and paper mills in Canada seldom permanently close.[50]

In theory there is a point beyond which a mill will not continue to operate. When a mill is no longer generating sufficient returns to cover its variable costs, and appears to have no hope of doing so within the foreseeable future, it will suspend operation. However, large mills with high variable costs usually are able to sustain operation during temporary lows. Once a larger mill passes the break-even point, it generally earns high profits, because of operational efficiency and usually a good wood supply base. Small marginal producers have lower fixed costs than larger mills. With a lower break-even point, small producers are better able to sustain profits during recessions. Therefore, it is unlikely that a mill will permanently be abandoned, unless the owners wish to leave the industry. In the majority of cases a firm will not choose to leave the industry for financial reasons, unless the returns it can achieve in an alternative investment opportunity are higher than in the existing operation, and the cost of taking advantage of a new investment opportunity (exiting the industry) and moving are acceptable in terms of the anticipated gains.

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[49] Barriers to entry are said to include advertising intensity, research and development, industrial concentration and risk. K.E.A. de Silva, op. cit., p.12.

[50] See Table 2:8, p.141, Chapter Two.

There are numerous non-economic reasons why a company or firm may decide to exit an industry. A firm or company might choose to leave the industry because of not wanting to operate within a particular political jurisdiction, and because the principals wish to make a statement. A firm may seek to leave the industry because of union strength, corporate image, lack of expertise among employees, or simply to consolidate management. Nonetheless, a company or firm will always try to recover the value of its assets. In most instances, in the pulp and paper industry, this will necessitate selling the mill, and with approval of the appropriate provincial government, the timber rights to new buyers. A company may have to sell a mill at a price well below the cost of replacing its assets during a recession. A company may be forced to temporarily suspend operations. However, only seldom will a firm abandon existing mill facilities unless buyers cannot be found because of timber supply problems and the assets have become obsolete.

Even if a company decides to vacate the industry, the overall impact on the industry and those who depend on the individual operation for a living is not necessarily bad. The economic welfare of a community or region does not always depend on individual ownership, even when a mill is the major or only employer in an area. If a mill has access to good local wood supply, others usually will seek to use the infrastructure already established to gain right of use to the valuable timber resources available. New operators would continue to pay taxes, earn foreign exchange, provide jobs, and pay salaries to local residents. In fact, new operators could be expected to improve production efficiency, and perhaps expand operations as a result of bringing a new commitment to the ongoing success of a previously economically tenuous facility. The essential point here is that an otherwise economically viable operation will not be closed for capricious reasons such as having to put in environmental controls. If the situation is such that a mill cannot be used to make a contribution to the economic success of a larger overall operation, and will not make a profit regardless of ownership, it will permanently cease operation. There is absolutely nothing that government can do by way of concession or subsidy short of outright purchase of the mill, that would alter the fact that the mill will eventually close.[51] If the conditions within a region are appropriate for operating a mill successfully over the long-term, the investment required to install pollution controls will not discourage others from taking advantage of an opportunity to operate what has the potential to be a successful mill operation.

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[51] The reader may recall government efforts to ensure the continued operation of the Ocean Falls mill, after Crown Zellerbach decided to abandon the mill.

The costs associated with installing pollution control measures can place a burden on some mills during periods when paper product sales are low, economic conditions are poor, and profit margins are squeezed. Vertical and horizontal intergration within the industry makes it difficult to obtain an accurate reading on the profit margins of mill operations. Profit margins within the industry as a whole appear modest when compared with other Canadian manufacturers, but compare favourably with pulp and paper producers in other countries with which Canada competes. Nonetheless, the precarious economic conditions of mills in the industry during low periods are more likely to result from the production capacity added during the previous upswing, than from the investment required to control effluent discharges. There are many who believe that the technological changes that take place as a result of a mill installing pollution controls adds to the value of the assets of a mill and improves long-term productivity.[52]

When the overall costs of a mill adopting the best in effluent control technology are examined against the capital investment requirements of operating within the industry, it is extremely difficult to accept that the effluent abatement control requirements of the Federal

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[52] Reports obtained from those who recently visited Sweden indicate that Swedish officials believe that one of the advantages of internal controls is that they "help to keep mills efficient and improve productivity".

Government would make any permanent difference to the economic viability of a mill operation.[53] The claims by industry that the investment required to meet federal effluent control standards during economic lows may be valid in some cases. When economic circumstances within the industry are such that a company or firm cannot justify the capital expenditures required to install pollution controls, then some temporary adjustment in terms of time may be appropriate. Such conditions serve as a valid reminder that the time-frame for bringing all of the industry into compliance should be chosen with care. It reminds government of the delicate difference between success and failure when competing in the marketplace. However, in those situations where a mill's assets have become obsolete, and the mill cannot acquire the necessary wood supply, concessions in terms of relaxing environmental control requirements will not prevent closure. Valid claims of economic hardship during recessionary periods do not serve as adequate reason for indefinitely postponing the need to install environmental controls.

Government Efforts to Offset the Economic Impact of Environmental Controls

It could be assumed that the use of minimal technical standards, which were established in conjunction with industry and the provinces, would obviate the need for federal negotiation with individual mills. With the freedom to choose the technologies necessary to achieve specified discharge reductions, there would be no need for individual mills to negotiate with government. However as noted previously, there are uncertainties with respect to interpreting the regulations and identifying altered and expanded mills. As stated repeatedly throughout this report, federal regulations are to be enforced taking into account the economic circumstances of industry, the potential impact on communities, and the social-economic well-being of those dependent on industry. Therefore, regional authorities usually negotiate with those deemed to be subject to the federal regulations either directly, or through provincial officials, in an attempt to reach consensus on control requirements. As part of the permit or control order system administered by the provincial governments, provincial officials regularly enter into negotiations with company or mill officials as permits expire and standards are reviewed. These sometimes trilateral negotiations cover a wide range of topics which usually include the controls required for environmental protection, the amount of time a mill is given to put controls in place, and frequently the level of reductions that can be achieved using alternative technologies. The cyclical nature of the industry, coupled with the importance of even very small and low production mills to individual communities, contributes to substantial concern among government officials about the impact of environmental controls on individual mills. The inevitable consequence is that governments sometimes allow concessions which may add to the difficulties of bringing all mills in the industry into compliance over time.

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[53] This observation is consistent with numerous other studies in both the United States and Canada. One recent Canadian study (1984) found that pollution controls had no effect on the productivity of labour growth. W.A. Sims and J.B. Smith, "The Impact of Environmental Regulation in Productivity Growth", Economic Council of Canada, Discussion Paper No. 241, September 1984. K.E.A. de Silva, *op. cit.*, p.20.

Whenever negotiations are entered into with the intention of reaching compromise, each party must be willing to be persuaded by the arguments of those with opposing views, if results are to be creditable and successful. However, in order to achieve fair and equitable settlement, each party must have comparatively equal incentive to force compromise. With government officials on one side and industry representatives on the other, the conditions necessary for reaching fair and equitable settlements do not exist at present. Under circumstances where government officials must avoid adding to the plight of individual mills regardless of the situation, and the regulations have become outdated and perhaps unenforceable, there is considerable incentive for government representatives to accept industry claims of economic hardship in order to avoid both legal complications and the risks associated with causing economic and social dislocation.[54] Under conditions where government enforcement efforts can be influenced by industry, company or mill officials can be expected to vigorously resist adopting the necessary controls. It can be anticipated that there will be pressure for individual mills to act in accordance with what is perceived to be in the industry's best interest. The economic advantages associated with resisting effluent control measures are obvious. The longer industry can delay the installation of effluent controls, the greater the economic benefit to industry. The last mill to make investment on abatement controls will enjoy economic advantage over others who have already met the same standards. Thus, governments sensitivity to the economic claims of industry, uncertainties about the requirements under the law, together with the presence of incentives for mills to avoid adopting pollution control measures, results in negotiating procedures which tend to favour industry.

The tendency of government officials to make concessions in response to industry complaints of economic hardship without valid supporting evidence adds immeasurably to the problems inherent in negotiating with individual mills.[55] During lows in the business cycle, mill representatives merely have to claim economic hardship. When financial analyses are undertaken to verify industry claims, such analyses usually are limited to examining the financial situation during the year in which discussions are taking place. Consequently, they serve to confirm the precarious economic conditions which exist during business downturns, because they do not take into account the long-term economic circumstances of mill operations.[56] When economic conditions improve, mill representatives are in a position to claim any of a number of different reasons for avoiding controls. Mill representatives sometimes contend that mill modernisation, and the upgrading of processing operations, will reduce waste discharges and specific controls should not be necessary. They sometimes agree to install specific controls, which may have been intended in any case, in exchange for being allowed to delay the often more expensive and usually more comprehensive system of controls which are necessary. Some mill spokespersons demand biological impact and treatment assessments to support the need for environmental controls.[57] In fact, it is commonplace in the industry for a mill to pay for the total cost of such assessments. The overall consequence of this pattern of negotiation is comparatively small improvements in overall environmental performance of industry during economic highs, when mills choose to invest in increasing production capacity, and perhaps even smaller improvements during lows because industry cannot afford to immediately make the necessary expenditures.

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[54] See p.197, Chapter Three.

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[55] "Kimberley-Clark to Spend $30 Million on Cleanup", The Globe and Mail May 13 1988, p.B13.

[56] Brian McClay of the Council of Forest Industries of B.C., noted that in 1988 "many mills are only now able to afford spending millions on pollution controls". Ben Parfitt, "Legal Group Seeks Pollution Reports for Pulp and Paper Mills After Violations Cited", The Vancouver Sun, May 12 1988 p.B4.

[57] Once again, it should be pointed out that mills which do not come under federal pollution abatement regulations are subject to Section 33 of the Fisheries Act. Under the provisions outlined in this section of the Act, it is not necessary to prove environmental damage. It is necessary to prove that the effluent being discharged into receiving waters is deleterious to fish. It is possible to use biological analysis to prove that damage is occurring, but the long-term effects of deleterious discharges can seldom be determined with absolute certainty. The standards specified under federal regulations are minimal requirements, which suggest that biological assessments probably would result in more stringent, rather than less stringent, control requirements for most mills.

Whether intended or not, the industry is able to delay adopting pollution controls by negotiating alternatives which allow mills to add to capacity during upswings, and avoid installing the controls necessary during downturns as a result of increased competition in the marketplace.[58] Thus, the negotiation pattern which has been established tend to benefit those who wish to delay making investments on pollution controls, and works to the disadvantage of those government officials responsible for controlling pollution from industry. Claims of economic hardship merely reinforce the perception that mills within the industry are unable to make the necessary investments.[59] Unfortunately, concessions which are made to individual mills on the basis of arguments of questionable economic merit, further discourages other mills from willingly investing in the necessary controls.[60] As a result there is very slow progress in bringing the total of industry into compliance with government standards, which in turn, engenders criticism from private interest groups about the willingness of government to enforce the law.[61]

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[58] It should be understood that this discussion is not intended as a criticism of either industry or government. Officers in industry have an obligation to avoid spending money belonging to the company or firm on behalf of shareholders, unless the expenditures are absolutely necessary. Similarly, government officials who must take into account the social-economic circumstances of industry, cannot be expected to prejudice their personal position and future influence on industry by adopting a strong position which may not be enforceable under the law.

[59] Keith Baldrey, "Mills Trying to Comply With Pollution Law, Minister Says", The Vancouver Sun, May 11 1988, p.A12.

[60] John Z. Swaigen, "A Case for Strict Enforcement of Environmental Statutes", Environmental Enforcement: Proceedings of The National Conference on the Enforcement of Environmental Law, ed. Linda F. Duncan, Environmental Law Centre Society (Alberta), 1985, pp.2-7.

Even with the uncertainties associated with defining expanded and altered mills, if the federal effluent control standards were applied to the total of each mill as they were deemed to be expanded or altered, and all negotiated agreements were proclaimed in law, the industry would eventually be brought into compliance over time. However, environmental officials do not proclaim negotiated compliance agreements under the law. Failure to legally proclaim negotiated agreements further weakens government's already precarious legal position with respect to enforcing regulations, if a mill fails to comply with the terms and conditions set out in the agreement. When this occurs, government officials once again are put in a position where it is felt that they have no choice but to accept the often very weak claims of industry. Mill modernisation usually results in less environmentally disruptive manufacturing operations, and certainly the modern technology used in newly constructed manufacturing facilities improves the environmental performance of industry. Environmental impact and treatment studies can be used to set priorities for environmental controls. Concessions for controls in one area in order to make advances in another can help to improve the overall performance of industry over the short-term. Nonetheless, when concessions or variances are allowed on the basis of mill modernisation, biological impact and treatment studies, and substituting one type of control for another, it is difficult to envision that the total of the industry will ever reach the point where every mill within the industry is in compliance with federal requirements.

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[61] Glenn Bohn, "Mill Wastes Said Unchecked", The Vancouver Sun, May 9 1988, p.9.

Many mills have already reached the point where further advancements in reducing discharges cannot be made without major investments in specific types of controls. While it would seem unnecessary and inappropriate to impose the use of secondary treatment on all mills in the industry, there are some that will not achieve the reductions necessary for compliance without external treatments. In situations where biological secondary treatment is needed, concessions which delay the use of external controls in exchange for internal controls are not satisfactory. One is not the substitute for the other. Internal controls very nearly always yield some advantage to a mill operation, and sometimes provide a positive rate of return on investment. External controls almost never yield any positive economic return. When internal controls are accepted as a substitute for external treatments, it nearly always results in further delaying the investments necessary to achieve compliance with the standards prescribed under the regulations.

As noted on several other occasions in this report, biological assessments are a necessary part of protecting the environment and should be used when there is a need to support discharge reductions not specified under the regulations. Biological impact assessments and treatability studies can be used by a mill to determine the types of controls necessary, and to develop a systematic approach for reducing discharges over time. Industry's use of such studies should be encouraged by government. However, government should not allow industry to use studies either deliberately or inadvertently as a means for circumventing regulations. If a mill is not in a position to make the necessary investments for reasons of economic vulnerability, then biological studies cannot be used to either support or refute such claims. The only legitimate means of using biological studies to assess the impact on a mill at a particular site is through the use of cost-benefit analysis. Cost-benefit studies practically always support the need for environmental controls.[62] Therefore, unless those mills demanding biological impact assessments are willing to install additional safeguards if the results of the assessments support the need for such remedies, and mill representatives are willing to accept that biological assessments cannot be used to forever postpone meeting the standards prescribed under the regulations, there is no practical advantage to agreeing to delay simply because mill representatives feel biological studies are needed.

EP personnel should focus their efforts on having mills reduce their effluent discharges to the levels set-out in the regulations, and not on choosing the control systems to be used. When EP staff either deliberately or inadvertently place themselves in a position to choose the technologies to be used at a mill, they are assuming responsibilities, which may limit the ability of government to influence further reductions in future. This problem can become more serious, if the controls identified and subsequently adopted do not achieve the projected results, either because they are inherently inadequate or improperly maintained and operated. If the impact on the receiving environment is such that further discharge reductions are necessary, or the need to control specific substances appears questionable, then decisions on concessions or additional safeguards should be made on the basis of biological impact assessments. If the financial circumstances at an individual facility appear to support the need for temporarily delaying the installation of particular control measures, then the company or mill should be required to provide financial information for independent audit. The results from independent audits should be assessed in terms of the overall economic condition of a mill over a period of time covering at least one business cycle (at least five years). Technical constraints do not serve as valid reasons for indefinately delaying the installation of environmental safeguards, when the merit of the technical standards have already been discussed at the industry level.[63] Neither should biological or economic claims of questionable merit be accepted as reasons for not setting a time limit for all mills within the industry to meet minimal federal requirements. Negotiations with individual mills on matters that pertain to the technical merit of adopting particular control measures in excess of those required to meet federal standards or to protect fish populations should be left to the provinces. The provinces have recognised responsibility for negotiating the terms of control and compliance permits for individual mills.

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[62] The review of studies undertaken in both the United States and Canada to assess the use of cost-benefit environmental controls in industry clearly supports validity of this statement. Charles R. Marshall, "Effects Division Environmental Report", Journal of Air Pollution Control and Waste Management, Vol. 38, No. 4, pp.372-373.

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[63] There is no question that environmental personnel should be available to provide advice to industry representatives on the pollution control technologies available, when industry feels that such advice is necessary. There are complications that can arise in individual mills which make it difficult to implement certain types of control measures. However, it is emphasised that industry has the right to choose where best to allocate its resources in order to generate a profit for shareholders, it also has the obligation to select its own pollution control technologies to meet discharge requirements outlined under federal regulations.

Changes to federal regulations and amendments to existing standards are not undertaken unless the proposed changes are discussed with industry representatives. This would seem entirely appropriate given the implications that such changes can have on industry. However, the uncertainties associated with defining existing and expanded facilities, combined with the differing legal interpretation of the regulations, results in the need to negotiate with individual mills. This dual level consultative process has resulted in negotiation patterns which are inconsistent and inappropriate to the enforcement of minimum standards which were specified on the basis of the control and treatment technologies available in the early 1970's. If individual mill negotiations were intended for reasons other than to assess the time needed to comply with the standards set-out under the regulations, then it would not have been necessary to adopt standards based on technical criteria. In fact, it would not have been necessary to set regulations. Negotiations within individual mills could be undertaken as part of the more general provisions included under Section 33 of the Fisheries Act. If the federal regulations were applied to all mills in the industry on an equal footing (the provisions for existing, expanded and altered mills were eliminated) and the industry could be encouraged to invest in environmental controls when the funds are most readily available, total compliance with federal standards could be readily achieved. The following section will be used to examine the use of government assistance programs to encourage investment on pollution controls.

Government Assistance Programs

In a free enterprise society anyone operating a business has to compete in the marketplace where ultimate success or failure will be determined by the consumer. Those who succeed usually are providing a product or service which is at least as attractive as those being provided by competitors. Anything that alters the terms or conditions for competing in the market can make the difference between success or failure. Government intervention can alter the terms and conditions for operating in the market, and as a result, determine success or failure. It is understandable, therefore, that the pulp and paper industry is sensitive to the way government exercises its authority and about the use of government assistance programs both in Canada and in competitor nations. The large and financially affluent elements within industry generally have been against government assistance programs, because industry-wide subsidies are usually more advantageous to small or marginal producers than to larger more efficient operators.[64] Although this has not prevented some large firms from arguing for government assistance, when advantageous to their own interest,[65] there is a growing concern over protectionism in the United States and over-capacity within the industry. As a result, there are many in the industry openly advocating an end to any form of direct financial assistance.[66] This has not always been the case. Many industry and mill representatives have argued the need for government subsidies to assist in implementing environmental controls. They supported this viewpoint by arguing that government discharge control standards put them at a disadvantage with their subsidised foreign competitors.[67] There remain many within the industry who maintain that the pollution control achievements of foreign producers are the result of heavy subsidisation.

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[64] Mathew Horsman, "Paper Plant Subsidy Plans Draw Outcry", The Globe and Mail, October 26 1987, p.B4.

[65] K.E.A. de Silva, op. cit., p.83.

[66] "Mills Expect to Lose Government Aid", The Vancouver Sun, January 29 1988, p.F1.

An examination of government supported pollution control financial assistance programs in Canada, indicates that Canadian taxpayers have provided the industry with a very substantial amount of help to control pollution. The government assistance programs identified in Chapter Three are listed in Table 6:3. This Table is used to show the views of mill representatives and provincial environmental officials on the two most effective of these various programs in helping to abate pollution from industry. It can be seen that there is a distinct difference of opinion between provincial government officials and mill representatives about the effectiveness of the programs. Most provincial officials, representing 41.7 percent of those included in the survey, felt that the Accelerated Capital Cost Allowance (ACCA) Program was one of the two most effective. More than 33 percent identified the Pulp and Paper Modernisation Program (PPMP) as one of the two most effective; 16.7 percent identified the Co-operative Pollution Abatement Research Program (CPAR) among the most effective. In contrast, over 66 percent of mill representatives felt that CPAR was one of the two most effective, 25.4 percent identified the PPMP as being effective, and only 5.1 percent identified the ACCA as effective. As can be seen from the information provided in the Table, the other programs which could be used to assist industry to reduce pollution were not considered important by either provincial government or industry representatives. ACCA, PPMP, and CPAR are considered to have been the most

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[67] Norman Bonsor, et al., op. cit., p.12-220.

TABLE 6:3

THE TWO MOST EFFECTIVE FEDERAL FINANCIAL ASSISTANCE PROGRAMS FOR POLLUTION ABATEMENT CONTROL ACCORDING TO INDUSTRY AND MILL REPRESENTATIVES[1] IN EACH REGION AND PROVINCIAL AGENCY OFFICIALS - 1987

	British Columbia[3]		Ontario		Quebec		Atlantic/ Prairies		Canada		Provincial Agency Officials	
	#	%	#	%	#	%	#	%	#	%	#	%
Pulp and Paper Modernization Program (PPMP)[2]	2	16.7	7	36.8	2	11.8	4	36.4	15	25.4	4	33.3
Co-operative Pollution Abatement Research Program (CPAR)	9	75.0	9	47.4	15	88.2	6	54.6	39	66.1	2	16.7
Accelerated Capital Cost Allowance (ACCA)	1	8.3	2	10.5	0	0	0	0	3	5.1	5	41.7
Development and Demonstration of Pollution Abatement Technology (DPAT)	0	0	1	5.3	0	0	0	0	1	1.7	0	0
Forest Industry Renewable Energy	0	0	0	0	0	0	1	9.1	1	1.7	0	0
Demonstration of Resource and Energy Conservation Technology (DIRECT)	0	0	0	0	0	0	0	0	0	0	1	8.3
	12	100.0	19	100.0	17	100.0	11	100.0	50	100.0	12	100.0

[1] Industry and mill representatives and agency officials sometimes did not express an opinion or gave only one choice as to the most effective program.

[2] The pulp and paper industry modernization program was limited to only Ontario. Quebec and Maritime Provinces.

[3] British Columbian mills that selected the modernization program selected it on the basis that it was good for the industry in helping to reduce the pollution from "eastern mills".

Source: Industry and Provincial Agency Survey, 1987.

important in helping industry cutback on pollution.

It could be expected that some within the industry would be less enthusiastic about the PPMP, because this program was limited to mills located in Eastern Canada. However, views about the usefulness of the PPMP did not vary according to location. Although many mill representatives expressed regret over what they perceived to be the preferential treatment given Eastern mills, mills which were not eligible to participate in the PPMP often indicated a preference for this program, because it helped to upgrade the environmental performance of the industry as a whole. Since the regional nature of this program does appear to have influenced industry's perception of the PPMP, on the basis of the information gathered during this study, it would seem safe to conclude: that the relatively inexpensive CPAR program, carried out at a cost of $10.6 million was preferred by industry over the PPMP, which cost the federal and provincial governments together about $55.8 million (18 percent of $3.1 billion)[68] to help the industry reduce pollution.

The PPMP was not specifically designed to help industry reduce pollution. In fact this program, which was jointly administered through a management committee consisting of the Federal Minister of Regional Economic Expansion and provincial ministers of development, had pollution abatement listed as only one of five eligible cost categories. The most important of the eligibility categories was the modernisation of production processes.[69] The PPMP has been subjected to a considerable amount of criticism since first introduced. The most notable criticism stems from its limited application to only eastern mills. There also has been criticism that the program was not needed, and as a result only marginally increased investment within the industry.[70] Whatever the reservation about this program, there is not much doubt that the program probably was poorly timed, because of the very serious downturn in the industry immediately after the program was introduced. To the degree that industry was encouraged to commit to investments, which would not otherwise have been made except for the program, it could be argued that the PPMP added to the debt load of industry at a time when many companies within the industry were already overextended. The program probably did add marginally to investment in pollution controls among some regional components of the industry, as appears to be the case in Quebec. However, when the percentage of investment on pollution controls is compared with the proportion of total investment on pollution controls in the years prior to the introduction of the program, it can be seen that the percentage of total investment on pollution controls by industry decreased during the years subsequent to the introduction of the program.[71] The PPMP appears to have had only marginal impact on improving investment on pollution controls in the industry.

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[68] See p.184, Chapter Three.

[69] K.E.A. de Silva, op. cit., p.91.

The ACCA allows depreciation for tax purposes of up to 50 percent each year on the total of the capital expenditures made by a firm on facilities and equipment. Any program which allows rapid write-off of depreciation on capital expenditures provides benefits, which can be most accurately depicted as an interest free loan on taxes which would otherwise be paid earlier if the program did not exist. In other words, the ACCA does not alter the total taxes paid, but allows extended use of tax funds which eventually have to paid. There is absolutely no benefit to a company or firm, which does not have sufficient taxable income to take advantage of an accelerated tax write-off. It does not benefit firms which already have accumulated tax write-off credits, that can be claimed during the same years in which the accelerated depreciation benefits accrue. Therefore, it can be assumed that during the years prior to 1972, when the ACCA could only be used to depreciate capital expenditures on pollution controls, the program probably did encourage some modest level of expenditures on pollution controls within the pulp and paper industry.[72] After 1972, when the program was extended to all manufacturing and energy conservation equipment, it is doubtful that the program made any appreciable difference in the amount of capital investment on pollution control within the industry.[73]

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[70] Ibid., pp.145-151. F.J. Anderson, op. cit., 1985. Peter Thain, The Political Economy of the Pulp and Paper Modernisation Program, Masters Dissertation, University of British Columbia, April 1984.

[71] See Table 5:13, p.395, Chapter Five.

The CPAR was a program specifically designed to encourage research on pollution abatement technology. This program encouraged a very significant amount of research on pollution abatement technology.[74] The results from some of the research undertaken as part of CPAR has been incorporated into the operation of existing mills.[75] As a jointly administered program, it encouraged regular discussions between industry and government representatives about the use of pollution control technologies within the industry. Roughly 30 projects were funded each year over the slightly more than eight years the program operated. The research projects were carried out at 43 research centres and supported by 21 different institutions.[76] It always is difficult to assess the value of research. The research undertaken through the CPAR program is no exception. Nonetheless, this program would appear to have been a success from a Federal Government perspective, if for no other reason than the fact that representatives from a number of different government departments and agencies were required to meet regularly with industry to review research grant applications and discuss the pollution problems of the industry. It raised awareness within the industry about the need for environmental controls, and helped government officials to better understand the complex problems faced by industry. However, the number of specific projects,[77] which can be cited as having advanced pollution control technology within the industry, attest to the very real contribution the CPAR program made in helping industry to improve its environmental performance.

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[72] Peter A. Victor, op. cit., pp.65-65.

[73] Some mill representatives felt that the amount of "red tape" associated with pollution control equipment expenditures, discouraged firms from using the ACCA to write-off pollution control expenditures.

[74] See p.183, Chapter Three.

[75] There are a number of technical advances which can be directly attributed to the research undertaken in the CPAR program. For example, improvements in countercurrent washing of brownstock has become a standard process design within the industry, partly as a result of work undertaken through CPAR. Michael J. Ducey, "Efforts in Chemical Bleaching Technology Emphasize Cutting Costs", Pulp and Paper, Vol. 60, No. 7, July 1986, p.50.

In the United States there is strong public resistence to providing industry with direct subsidies. In many cases, industry itself resists government financial assistance because of the impact that government intervention can have on market competitiveness. Nonetheless, governments do provide industry with both direct and indirect subsidies.[78] Federal assistance usually is in the form of indirect subsidies while state governments provide both direct and indirect assistance. With indirect subsidies by the Federal Government, and 50 different states participating in a wide variety of often indirect and complex financial assistance programs, it is difficult to determine exactly how much government assistance is provided to the United States' pulp and paper industry.[79] The Federal Government provides all industry with investment tax credits, and accelerated depreciation benefits. Eligibility for allowances under these programs vary with political administration, and as a result, have on occasion pertained only to industry expenditures on pollution controls. Sometimes they are applied to all of industry for all capital expenditures. Although, the estimated benefit to industry varies considerably according to the source from which information is obtained, there is no doubt the pulp and paper industry has benefitted from these programs.

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[76] Douglas Jones, The Cooperative Pollution Abatement Research Program: A Critique, (unpublished), Douglas Jones Consultants Ltd., prepared for the Environmental Protection Service, Department of Fisheries and the Environment, October 1977.

[77] Loc cit.

The United States Federal Government also operates a grant system for publicly owned treatment works. This program is aimed at assisting municipal or town authorities install treatment facilities. Some mill operations are known to have linked their discharge treatment systems to municipal sewage facilities, and are thought to have benefitted from the publicly owned treatment works subsidies. However, it is claimed that it is cheaper for mills to build their own facilities, and have dedicated treatment systems based on mill waste, rather than complying with the stringent requirements applied to municipal treatments by government. Of the 220 indirect (as opposed to direct) discharge mills in the United States, it is estimated that as many as 40 percent of the small discharge mills (which together account for between fifteen and twenty percent of total pulp and paper production in the United States) benefitted from capital grants of up to 75 percent provided for municipal sewage treatment. It can be estimated that those mills which did benefit from this program could have expected to reduce their municipal sewage fee costs by up to 25 percent.

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[78] The information provided in this section on U.S. assistance programs was gathered from a variety of sources. EPA offices in Washington, D.C., Seattle, and San Francisco provided information on federal assistance programs and an overview of some of the state funding initiatives. Information also was obtained from the Washington State Department of Ecology in Olympia Washington.

[79] Norman Bonsor, et al., op. cit., p.12-227.

It is also known that the United States pulp and paper industry benefits from incentive railway rates, which have grown over time.[80] Transportation cost increases, which are applied in a selective manner, have given mills in some areas of the United States product delivery cost advantages. It has been estimated for example, that delivery costs from Eastern Canadian mills to the north central United States have increased by 82 percent since 1971, while the delivery costs of Southern United States' mills to the Northeastern and North Central regions have increased by only 44 percent during the same period.[81] Since delivery costs for Canadian mills represent about sixteen percent of the total cost of making finished newsprint product available in market, transportation incentives do provide competitive advantages to mills in the United States. Even though these subsidies are not in any way related to pollution controls, neither did the PPMP pertain only to pollution controls.

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[80] Unpublished study by N. Skoulas, Transport Costs and Their Implication for Price Competitiveness in Canadian Goods-Producing Industries, Consumer and Corporate Affairs, Research Monograph No. 9, (unpublished), Ottawa, 1981, pp.47-48. Cited in K.E.A. de Silva, op. cit., p.10.

[81] Ibid.

Practically all states with pulp and paper mills in the United States have provided the pulp and paper manufacturers within their jurisdiction some financial assistance for adopting pollution controls. Although the amount of help provided varies greatly according to state, it is generally considered that the level of assistance provided varies with the regional economic importance of the industry. In those areas where the industry is a major factor in the economy, state and local governments tend to be more generous than in areas where the industry is less significant. Some states built treatment plants for mills with Federal Government assistance and leased the facilities back to the mills. At least one state is known to have found this practice unconstitutional in the courts.

Many, if not most states, have provided mills with financial assistance in the form of low rate interest bonds. For example, the State of California provided financial assistance to pulp and paper plants for the treatment facilities required to meet water pollution control requirements through the use of low interest bonds.[82] These low interest bonds enabled enterprises to finance pollution abatement facilities at annual interest rates of two to five percent lower than the comparable conventional rates of the time. Under these arrangements, five different corporations were able to float low interest bonds ranging from $850,000 to $22 million between 1974 and 1982. The State of Washington provided tax credits consisting of sales tax exemption, and a "Business and Occupation Tax Exemption" of two percent per year for 25 years on the capital costs of environmental control equipment.[83] Approximately $600 million worth of capital equipment was installed during the existence of these programs in Washington.

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[82] California Pollution Control Financing Authority, Register 86, No. 27-7-5-86, State of California, 1973. California Pollution Control Financing Authority Act, Chapter 1, Ch. 957, State of California, 1975.

Even though it has not been possible to obtain similar information about other state supported financial assistance programs in the United States, it can be seen from the foregoing that the pulp and paper industry has received significant government help. It should be noted, that the administration of these programs were tightly controlled. Companies were not allowed to use the funding made available through these programs for any purpose other than to control pollution. It is difficult to determine whether the total of the help given to the industry in the United States was greater than in Canada. In some states, in some situations, it might have been more generous than it would have been in a similar situation in Canada. However, this is speculation. It would seem reasonable to conclude on the basis of the information received, that the United States' pulp and paper industry has not received the same level of government assistance as in Canada. Nonetheless, neither can it be claimed that the industry in the United States has not received considerable help from government.

Although it is difficult to make comparisons between the financial assistance programs in the United States and Canada, the same is not true for Sweden and Finland. Neither Swedish or Finnish pulp and paper manufacturers have received the same amount of government assistance as has been provided in Canada. In fact, a recent article notes the reaction of Karl Kosk, Senior Vice-President of Finnboard (which markets Finnish paperboard products) as being:

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[83] Pollution Control Facilities - Tax Exemptions and Credits, Chapter 82.34 RCW, State of Washington, 1977. Regulations Relating to Tax Exemptions and Credits for Pollution Control Facilities, Chapter 173-24 WAC, State of Washington, 1971.

> ....genuinely shocked to learn from recent visitors from Canada the extent to which one of their (Canada's) projects is supported by government.[84]

It was further noted that Thomas Nysten of the Finnish Mills' Association (FINNPAP) stated: "that newly built mills here (Finland) don't get any support from government".[85] Although similar information is not available for Finland, it has been documented that the Swedish government provided their pulp and paper manufacturers with approximately $350 million over the period 1975 to 1982, during a period of industry restructuring.[86] The Swedish government also allows accelerated depreciation on machinery and equipment, although it has been described as being less generous than in Canada.[87] One particularly attractive feature of the Swedish taxation system, which if applied in Canada would help industry encourage a steady stream of investment during both lows and highs in the business cycle, is the use of a general investment fund reserve. Under the provisions described in the recent study by the MISA Expert Committee on Kraft Mill Toxicity, Swedish companies are allowed to allocate 50 percent of pre-tax profits to a reserve for future investment.[88] With government permission these funds can be drawn on later, without tax liability.[89] Although it is unclear whether the necessary legislation has been enacted at this time, it was the intention of the government in Sweden to limit the use of investment reserves within the pulp and paper industry to expenditures on pollution controls.

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[84] Wayne Karl, "The Finnish Report", Pulp and Paper Journal, Vol. 40, No. 8, October 1987, p.24.

[85] Ibid.

[86] Norman Bonsor, et al., op. cit., p.12-226.

[87] Ibid., p.12-222 and 12-223.

[88] Loc. cit.

[89] The system used in Sweden could be adapted in a number of different ways to encourage investment, through a self-administered rotating fund with limited life. The money paid into the reserve by Swedish companies is kept in non-interest bearing deposits.

In almost every field of human endeavour there are ideas, beliefs, and perspectives that become part of the conventional wisdom. It is believed by many students of public administration that government programs should be designed and delivered solely in terms of the purpose intended to be served. In the pulp and paper industry it is generally believed that government requirements to reduce pollution puts domestic producers at a competitive disadvantage with government subsidised foreign competitors. These two perspectives were examined in this section and the findings serve to lend credence to the former and bring into question the latter. The popular and less costly CPAR program, which was established for the purpose of encouraging research on pollution control technology, was more effective in encouraging industry to adopt pollution controls than either the multi-purposed modernisation program or the ACCA depreciation provisions allowed for tax purposes. This does not mean that broadly based government efforts should be designed without regard for the environment, it does suggest that government pollution programs should have a clearly specified single set of consistent objectives. In an industry where pollution abatement is perceived as a threat to competitive position, a program designed to upgrade manufacturing and make industry more competitive is not likely to be an effective or efficient means of encouraging the use of pollution controls.

Neither has it been found that Canada's major competitors benefit more from government assistance than Canadian producers. Consistent with what was found to be the case in at least one other recent study, the pulp and paper industry in Canada received as much or more government assistance than three of its major competitors in international markets.[90] It is speculated on the basis of limited information available from the United States, that perhaps some individual pulp and paper manufacturers have received as much government assistance as Canadian manufacturers. However, when taken as a whole, it is certain that United States pulp and paper manufacturers receive less direct federal assistance than in Canada. Swedish and Finnish producers have received far less government assistance than their Canadian counterparts. Perhaps as a result of self-reliance in Sweden and Finland, pulp and paper manufacturing has become more concentrated in those countries. The trend among Finnish companies has been to join forces to improve efficiency in international competitiveness since the early 1970's. From 31 companies in 1970, the Finnish industry has amalgamated to fifteen companies today.[91] The Swedish industry has decreased from 90 companies in the late 1970's to 30 in 1985. It is claimed that as few as four Swedish companies will remain active in the industry by the year 2000.

Economic Trends in the Canadian Pulp and Paper Industry During the Remainder of this Decade and into the 1990's

The Canadian pulp and paper industry is currently undergoing the single greatest increase in production capacity since the ten year period between 1911 and 1921.[92] There is a major shift in pulping processes which surpasses the similar, but somewhat less pronounced, shift to kraft pulping during the earlier part of this century. The structure of the industry can be expected to change quite dramatically as a result. It can be anticipated that TMP, CTMP, BCTMP, and perhaps other developing pulping processes, will dominate the industry in the not too distant future.[93] Between 1976 and 1986, kraft pulp production increased by 1.5 percent per annum, and thermo-mechanical pulping increased by 27 percent each year.[94] CTMP production increased by about 2,400 tonnes and TMP by 1,100 tonnes during 1986. In 1987, CTMP increased by nearly 2,590 tonnes and TMP by 660 tonnes.[95] Even in Ontario, where the tendency to move into these new pulping processes appears less strong, CTMP market pulp production has grown by seven percent per annum over the ten year period ending in 1987.[96] CTMP production is not tied solely to integrated mills. To date, the major growth in BCTMP production has been in market pulp. However, BCTMP has been successfully replacing chemical pulps for many high valued papers and paperboards, as well as tissue products.[97] It is estimated that by the year 2005, that global production of CTMP product will have reached 4 million tonnes per year.[98]

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[90] Norman Bonsor, *et al.*, *op. cit.*

[91] Wayne Karl, *op. cit.*, p.25.

[92] See Table 1:10, p.36, Chapter One.

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[93] Dennis Bueckert, "New Process Promises to Make Pulp Mills Smell Nice", *The Vancouver Sun*, May 10 1988, p.E1. Stephen G. Williams, *The World Marketplace Canadian Market Pulps' of Evolution and Technical Growth*, presented to the 70th Annual Convention of CPPA, Montreal, 1984.

[94] Norman Bonsor, *et al*., *op. cit*., p.6-99

[95] Ray Leask, "Thirteenth Mechanical Pulping Survey World Design Capacity TMP, CTMP, CMP Now Nearly 25 Million Tonnes a Year", *Pulp and Paper Canada*, Vol. 89, No. 3, March 1988, pp.22-27.

[96] Woodbridge, Reed and Associates, *A Study of Ontario Forest Products Industries*, a report prepared for the Ontario government, Toronto, November 1987, p.62.

[97] Wayne Karl, "Canada Put CTMP on the Map", *Pulp and Paper Journal*, Vol. 41, No. 3, March 1988, p.26. "Mechanical Pulp Serve a Variety of End Uses as Capacity of Line Grows: PPI Survey Shows Investment in Modern Mechanical Pulps is Increasing - About 200 Installations are in Operation or Planned", *Pulp and Paper*, Vol. 60, No. 6, June 1986, pp.73-76.

[98] *Ibid*., p.29.

The economic advantages of producing thermo-mechanical pulps are impressive. It is not only cheaper to build a CTMP mill than a similar sized kraft mill,[99] but fiber recovery is higher. It has been observed that a BCTMP mill of minimum efficient size requires about 75 percent less fiber than an optimal sized kraft mill.[100] However, a kraft mill usually achieves fiber recovery yields of between 40 to 45 percent, compared to a CTMP mill which has a yield of between 90 and 92 percent. This higher recovery rate could conceivably increase the value of timber holdings for a company using CTMP processing by up to 80 to 90 percent. Although there is some reported market resistence to CTMP, some operators claim that the use of CTMP process improves product quality and flexibility.[101] CTMP requires about three times as much energy as kraft pulping. However, rising wood chip prices and chemical costs add to the attractiveness of thermo-mechanical pulping. The only potentially dark cloud on the horizon is the classification used for woodfree grades. Woodfree paper means a maximum of ten percent mechanical pulp can be used as furnish in European markets. In North America the content is even lower for writing or printing paper, because waste paper dealers will not accept grades with stone-groundwood, TMP, or CTMP furnish.[102] Still the new greenfield operation in White Court Alberta will be producing printing and writing paper, and company officials have targeted Western Europe along with the United States and Japan as its primary markets.[103]

There are many who believe that the worldwide shift to thermo-mechanical pulping will result in making Canada a world leader in this type of pulp processing. Canada with its increasingly valuable hydro-power assets, and its vast diversified forest lands, is in a good position to take advantage of this type of production. Lodgepole pine (softwood), spruce (softwood), and aspen (hardwood) are considered prime species for CTMP. Canada has an abundance of all three of these species. Alberta has ample supplies of aspen, lodgepole pine, and spruce, while the Cascades and Northern Regions of Canada have plentiful quantities of black spruce. Black spruce reproduces from both seed and from what is referred to as "layering". This means that as the lower level branches become covered with mosses, litter roots develop which eventually become new trees.[104] Black spruce, aspen, and pine are available throughout Canada, including far northern regions. The use of the CTMP has the potential to contribute to expanded and more efficient use of Canada's forest lands. The ubiquitous nature of the species which can be used in CTMP processing adds to the value of Canada's existing forest lands, and further contributes to the economic advantages of using CTMP processing.

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[99] See p.99, Chapter Two.

[100] Norman Bonsor, et al., op. cit., p.12-229.

[101] Wayne Karl, op. cit., p.26.

[102] Ibid., p.29.

[103] "Miller Western Bleach CTMP Mill Features Latest Technology, Design: Construction Should be Underway on a Highly Flexible Greenfield Mill at White Court, Alberta, with Startup Plan for Mid-1988", Pulp and Paper, Vol. 61, No. 6, June 1987, p.81.

The shift to thermo-mechanical pulping in Canada is intensified by the recent buoyant economic conditions within the industry. Virtually all companies in the industry have been enjoying greater returns and stronger market demand.[105] It is currently estimated that about $6 billion will be spent upgrading mill facilities and increasing capacity over the next few years. A substantial amount of this new capacity will be in thermo-mechanical pulping. This is shown by recent figures from

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[104] R.C. Hosie, Native Trees of Canada, Canadian Forestry Service, Department of the Environment, Ottawa, reprinted 1975, p.72.

[105] "Canadian Earnings Swelled 77.7% in 1986", Pulp and Paper, Vol. 61, No. 4, April 1987, p.27.

British Columbia, where seven of thirteen projects listed with the Provincial Government for expansion and development in the pulp and paper industry involve some addition to TMP, CTMP, or BCTMP processing.[106] This pattern of investment does not portend the immediate demise of kraft pulping in Canada. Kraft pulp can be expected to remain the preferred pulp for many end product uses for many years. Brightness reversion is a potential problem for all softwood CTMP. As noted previously, there are some woodfree classification problems and there is likely to remain some market resistence to thermo-mechanical pulps, because of the tried and proven success of kraft pulp over many years. Nonetheless, it is generally conceded that there is excellent potential for increasing the market for thermo-mechanical pulps in the United States and in Pacific Rim countries where demand has been growing at a very substantial pace. As the technologies of thermo-mechanical pulping improve, and other nations which do not have low cost energy sources maintain their kraft production, more and more Canadian producers are likely to find it increasingly attractive to shift to thermo-mechanical pulping processes. The relatively smaller optimal production size of a CTMP mill also makes it a suitable alternative process for some existing sulphite operations.

The very severe economic conditions of the early 1980's resulted in a leaner more efficient pulp and paper industry throughout the world. When markets began to improve, the Canadian pulp and paper manufacturers, like producers in other nations, were in a good position to take advantage of the upturn. This contributed to the recent record high profits, and in turn, these record high profits have stimulated enormous investment within the industry. There also is increasing worldwide recognition that the amount of uncommitted forest land is declining at a rapid rate. Stimulated by the long-term advantages of acquiring increasingly scarce good quality wood supplies, and by the desire to maintain access to market pulp on an ongoing basis to feed final product production, large paper companies have been expanding into new geographic areas throughout the world. Fletcher Challenge, Daishowa, Oji, and the Chinese Government all have made recent acquisitions in Canada. Canadian based companies also are looking to other nations to expand their operations. Consolidated-Bathurst has been considering joint venture pulp and paper projects in China and the Soviet Union.[107] Abitibi-Price has been negotiating with the Venezuelan Government to build a $450 million, 2,000 ton newsprint mill in that country.[108] Noranda Forest has been examining the prospects for building a joint venture $900 million pulp mill in Tasmania.[109] As one industry executive observed, there is "a real appetite out there for forest holdings".[110] Therefore, fueled by record high profits, large companies are seeking to stake claim on an ever decreasing available amount of forest lands worldwide, by securing a place within an industry, which will enjoy larger profit margins and be more difficult to enter in future.

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[106] British Columbia Major Projects Inventory, Ministry of Economic Development, March 31, 1988.

Current buoyant economic conditions will add to the amount of concentration within the industry in the not too distant future. For more than a year now, industry analysts have been cautioning against over-expansion, and warning of the pending dangers of market downturns.[111] For example, it was noted in the Canadian Paper Analyst:

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[107] "Consolidated-Bathurst Eyes Pulp Project in China", The Globe and Mail, November 27 1987, p.B11.

[108] Liama Dingwall, The Financial Post, December 21 1987, p.27.

[109] "Noranda in Venture to Build Aussie Mill", The Vancouver Sun, May 5 1988, p.C5.

[110] Kimberley Noble, "Noranda to Sell 15% of Its Revamped Forest Unit", The Globe and Mail, May 27 1987, p.B2.

> One of the consequences of the 1982/85 period was the closure of a number of uneconomic facilities and at the same time, a conserted attempt was made to improve productivity at (sic) mills that continued in operation. This, in most cases, involved both a injection of investment capital and a reduction in manpower.[112]

Later in this same monthly issue it was stated:

> The inescapable conclusion from this admittedly superficial analysis is that even with a dramatic increase in exports, mainly to the United States, the Canadian fine paper industry will have a great deal of difficulty reaching operating rates of 90% or more in the next few years. This is particularly painful when one realises that 90% plus operating rates have been the norm for this segment of the industry for the past decade.[113]

Despite all the cautions and concerns, production capacity has been expanded at a substantial pace. One observer noted that:

> ....the expansion may be laying the ground work for disastrous over-production and much lower newsprint prices in the early 1990's.[114]

In recognition of the potential consequences of excess capacity, and the effects this will have on individual companies when market conditions begin to deteriorate, many companies are seeking to position themselves to minimise risk and to take advantage of the opportunities which become available during economic declines. Some companies are merging to consolidate their operations and to achieve improved efficiencies.[115] Some firms are moving more rapidly into the production of higher value added products to diversify product line and to reduce risk.[116] This is particularly true of the growth and expansion taking place in British Columbia. Still others are looking to acquire new assets when the downturn occurs. Roger Wiewel, Vice President of Marketing for MacMillan Bloedel stated:

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[111] Kate Dunn, "Busy Pulp-n-Paper Firms Exercise Expansion Caution", The Vancouver Sun, November 25 1987, p.C4.

[112] Canadian Paper Analyst, Vol. IX, August 1987, p.4.

[113] Ibid., p.8.

[114] John Schreiner, "Newsprint Boom Could Bring Bust", The Financial Post, May 7-9 1988, p.1.

[115] CIP is currently seeking to merge its wholly owned CIP Inc. with Great Lakes Forest Products. Alan Gray, "Giant a Tough Haul for Bill Stinson: Canadian Pacific's Not Only Big, But It's Also Been Ailing Recently", The Vancouver Sun, June 23 1988, p.E5. "Fletcher Man in B.C. Says Forest Jobs are Safe", The Vancouver Sun, June 25 1988, p.G5. "BCFP Sets U.S. Subsidiary Expansion", The Vancouver Sun, July 19 1987, p.B5.

> MacMillan Bloedel sees a recession as the time when the fittest survive to take over of the less fit.[117]

The overall consequence of this competitive manoeuvering will be greater concentration of ownership within the industry, and an industry able to compete more effectively in international markets.

The last economic peak in the pulp and paper industry was in 1978, when newsprint prices were high and the industry was operating at about 81 percent of capacity. As usually is the case, the expansion that took place as a result of this upturn added to the very difficult conditions, which followed in 1982. Although industry leaders are aware of the problems associated with unrestricted investment during periods of prosperity, they often cannot avoid making large investments. Pulp and paper machines cost hundreds of millions of dollars and take two or three years to build. It requires years to recover that size of investment. The latest technologies (e.g. new paper machines) often cannot be added in small increments. However, the difference between more recent declines in economic conditions and the one which will take place in the not too distant future appears quite substantial. Two of the last three downturns in the pulp and paper industry coincided with general economic slumps. In 1974, there was a general downturn as a result of the "oil crisis". In 1982, there was an economic contraction because of inflation and high interest rates. The industry appears to be in much better position to respond to the forthcoming downturn as a result of the experience gained during the severe economic slump of 1974 and 1982. In fact, it is doubtful that the industry has ever been in a better position, through its own efforts, to ride the next downturn and meet the challenges of the coming decade. This does not mean that all mills in the industry will be able to ride the next downturn without economic hardship. In fact, quite the opposite is true. This suggests that the main elements within the industry will be in a position to acquire the assets of marginal, and likely smaller operations.

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[116] Kimberley Noble, "MacMillan Begins to Shift Out of the Survival Mode", The Globe and Mail, March 27 1987, p.B5. "Scott Paper May Install Fifth Machine at Crabtree", The Globe and Mail, April 16 1987, p.B8.

[117] "Keen for Recession, Mac-Blo Executive Says", The Vancouver Sun, November 6 1987, p.1.

Of course there are those who feel that the production capacity expansion which has, and will likely continue to take place over the next several months, will be matched by rising market demand.[118] However, without optimism, there would not be over-capacity in any industry and also very little growth and expansion. Pending, and sometimes committed, investments for increased capacity in newsprint production could bring as much as 1.5 million tonnes on stream by 1991.[119] It can be projected that much of this investment will not actually occur. There are fears that inflation is on the rise,[120] interest rates are likely to increase in both Canada and in the United States, and the roughly five year intervals between market highs in the industry suggests that the buoyant conditions have likely crested. The value of the Canadian dollar has increased in terms of the United States dollar from an average of 75 cents during 1987 to about 83 cents currently.[121] Even though the value of the Canadian dollar can be expected to fluctuate, a higher dollar will undoubtedly result in reducing revenue within the Canadian industry and dampen the enthusiasm for further investment in new production capacity.[122] A softening of the market for Canadian forest products will likely precede a more general downturn over the next roughly eighteen months. Although extremely difficult to predict exactly how long the downturn will take, and how severe it will be once it occurs, it appears certain that the longer and more accentuated the market decline, the greater the amount of rationalisation within the industry.

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[118] Mike Stainsly, "B.C. Producer Doesn't Fear Newsprint Plan", The Vancouver Sun, July 8 1987, p.C5. Margret Piton, "Prospects for Forest Products Stays Strong", The Financial Post, June 13 1988, p.15.

[119] "Newsprint Capacity Could Tip Market Scales", Pulp and Paper, Vol. 62, No. 3, March 1988, p.31.

[120] "Inflation Rate in 24 Industrial Nations Rose in February", The Los Angeles Times, April 28 1987, p.I25.

Although there are likely to be some disruptions during the period in which rationalisation is proceeding, over the longer term, increased concentration will improve economic performance within the industry. Better economic performance, combined with the advantages associated with manufacturing higher value added products, should result in a stronger more competitive industry. This does not indicate that mill closures necessarily will occur. Whether mill closure occurs or not depends most critically on wood supply, and on the land tenure arrangements made with provincial authorities. Even though efficient mills are capital intensive mills, which usually require less labour per tonne of production, this does not mean less overall employment within the industry than there might otherwise have been without rationalisation.[123] Inefficient operations do not provide secure jobs. The number of long-term secure jobs within the industry depends on how well each mill in the industry is able to compete internationally, and in turn, on production efficiency. It can be anticipated that the changes taking place within the industry will increase the number of secure job opportunities available among mills in the industry, because of improved productivity. Even among those mills using processes which generate wastes that are difficult to control, efficient mills usually are environmentally cleaner than inefficient mills. This omens well for the environmental performance of the industry over the coming decade. It also suggests that many companies will be in a better position to absorb the costs associated with environmental controls, than perhaps has been true in the past.

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[121] The effect that the changing relative value of the Canadian dollar can have on the forest products industry is revealed in a recent article about lumber mills in B.C. "Dollar - Caused Mill Closure Seen", The Vancouver Sun, June 17 1988, p.H1.

[122] Recently announced price increases for pulp and some higher quality paper products could be regarded as a matter of taking advantage of good market conditions while they last. Kimberley Noble, "Pulp and Paper Product Prices Being Pushed to Record Highs", The Globe and Mail, June 29 1988, p.B2.

The long-term prospects of improved environmental performance within the industry appear excellent. The very significant shift to new cheaper, less water demanding, and potentially environmentally cleaner thermo-mechanical processes will be of considerable help in reducing industry waste discharges. The level of loadings reductions actually achieved because of this shift to these new processes will at least partially depend on the deliberate actions of individual mills. Nonetheless, these new processes will help reduce the total amount of effluents which contain some dangerous and environmentally harmful toxic organochlorine compounds.[124] These processes also provide a suitable alternative manufacturing process for some of what has been referred to as the environmentally "problematic sulphite" sector of the industry.[125] A more concentrated corporate structure within the industry will serve as further impetus for small mill operations to seek alternatives or even close. As the industry becomes more concentrated, the economies which can be achieved from larger more integrated operations will reduce overall average production costs in the industry, and small independent operators will find it more difficult to compete. Those mills which are in a position to shift to thermo-mechanical processing are likely to do so. In fact, the number of mills using the low yield sulphite processes has decreased by about 50 percent over the past ten years. Many of these mills have adopted thermo-mechanical processes. The prospects for further environmental improvements in this sector of the industry appears good. There will continue to be a few mills which will find it economically difficult to meet federal effluent standards. Nonetheless, the environmental improvements that can be expected to take place within the sulphite sector of the industry, together with the recognition that given sufficient time practically all mills within the industry can meet federal discharge requirements, bodes well for the future.

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[123] It is often assumed that economic expansion within an industry inevitably leads to increased job opportunities. This is true of the economy as a whole, but it is not necessarily true of an individual industry or mill. Increased output or expansion often results from improved efficiencies. In capital intensive industries, this can lead to reduced labour requirements. At the very least, the introduction of new technology will usually result in decreasing the number of lower skilled jobs available. These reductions may or may not be more than offset by an increase in the number of skilled positions. The trend within the industry over many many years has been toward increased labour requirements, but labour costs as a percentage of the total value of output has declined. See Table 1:10 and 1:15, Chapter One, pp.36 and 52.

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[124] Norman Bonsor, et al., op. cit., p.1-14.
[125] Peter A. Victor, et al., op. cit., p.33.

Summary

Under the commonly accepted principles of operating a business in a free society, the firm pays the total cost of producing the products and services offered for sale. If the revenue received by the firm exceeds the costs associated with producing and selling its products in the market, the business makes a profit. If the revenue received is less than the cost of producing and marketing the products, the business loses money. The success or failure of a business depends largely on the personal preferences of the consumers in the marketplace. The degree to which a profitable business is successful in servicing the needs of society, depends on how well the total of the costs imposed on society (often exacted on industry in the form of government taxes, fees, and royalties) for producing the product are incorporated into the cost of production. Unfortunately in the absence of direct government intervention, the costs imposed on society as a result of pollution are not always borne by producers, and as a consequence, are seldom included in the production costs or reflected in the price paid by consumers. The two principal beneficiaries from failure to include the cost of pollution in the price paid for the final product are those producing and consuming environmentally disruptive products. Those who place value on having a clean environment assume a disproportionate share of the costs of production in the form of pollution. In other words, those who are concerned about the environment are assuming costs which they would not willingly accept if given the choice. This results in distributional effects which benefits one segment of society at the expense of another.

The distributional effects or inequities which result from the sale of environmentally disruptive products can be addressed by taxing industry to provide government with revenue to clean-up the resulting pollution. However, this would be inefficient and ineffective, because the damage caused by pollutants seldom can be immediately and completely reversed once reaching the receiving environment. Those manufacturing and using products, which are less environmentally disruptive to produce would be paying for alleviating the pollution caused by others, who under such circumstances, would have no incentive to protect the environment. Therefore, the solution often put forth as being ideal is to incorporate the cost of pollution into the price paid for the final product by having producers assume the full cost of disruptive discharges. To some degree the imposition of pollution standards on industry serve to "internalise" the cost of manufacturing environmentally disruptive products, thereby providing incentive for industry to reduce waste discharges. To the extent that producers are required to incorporate the cost of pollution controls into the market price of their products, those using products which cannot be produced without generating environmentally disruptive materials are sharing in the responsibility for the environmental problems caused as a result of their preferences.

It is not technically or economically feasible to control all pollution from the pulp and paper industry. As a result in most countries, the collective society accepts some of the costs from industry in the form of pollution in return for the benefits (e.g. jobs, income, and foreign exchange) which pulp and paper manufacturers provide. The problem for government is that the amount of pollution society is willing to accept varies greatly according to individual preferences, the background and experience of different social groups, and through time. Consequently, the approaches used to protect the environment differ quite considerably throughout the world. In the Eastern European countries, the use of discharge effluent fees play a prominant role in pollution control. Hungary and East Germany use a charge system in combination with effluent standards. France and the Netherlands charge on the basis of the discharges caused by equivalent populations according to an estimate on assimilative capacity. West Germany has an estimated fee structure which can range up to $1 million for loadings comparable to those caused by a small pulp manufacturer in Canada. The number and variety of approaches used by different jurisdictions throughout the world clearly indicates the widespread recognised need for government intervention to control pollution from the pulp and paper industry. The approaches used often involve some form of regulative procedure, which results in providing industry with economic incentive for responsible environmental behaviour. They also appear to vary with the economic circumstances of the country, the competitive conditions in which the industry operates, and the collective concerns society has for controlling pollution. There is little doubt that the importance that society places on controlling pollution varies directly with what is perceived to be the natural assimilative capacity of the receiving environment, and not with the political philosophy of government.

Although it is impossible to define precisely how much pollution

Canadians are willing to accept in return for the benefits provided by industry, the principles established when the federal effluent control standards were adopted, implicitly defines the range over which such controls should be administered. If the requirements are overly stringent, then the cost to industry will be high and losses of jobs and income will occur, because of deterioration in international competitiveness. If environmental control requirements are overly lenient, then there will be unnecessary degradation of the environment. To the degree Canada's environmental laws are less stringent than similar laws in those countries importing Canadian produced pulp and paper products, Canada will be subsidising other countries by accepting pollution levels not tolerated in customer nations. Insofar as individual regions choose not to maintain discharge control standards consistent with the national norm, there is a possibility for those regions to become pollution havens within Canada, and at the same time attract pollution from other nations. It follows therefore, that even though discharge limits should not be set and enforced in a way that weakens the pulp and paper industry's competitive position in world markets, neither should federal standards be set lower than other competitor nations, unless Canadians are prepared to accept the pollution problems of these nations in order to protect what are often inefficient mill operations which cannot otherwise compete internationally.

The very substantial importance of the pulp and paper industry in Canada, convincingly underlines the need to both tailor pollution control regulations to the economic circumstances of the industry, and the environmental needs of Canadians. However, not only do the environmental concerns of Canadians vary significantly from region to region, the importance of the industry also varies according to location. Therefore, it is not surprising that some provincial and municipal authorities might be willing to accept higher levels of discharge than others in return for the benefits generated by the industry. It is for this reason that the federal pulp and paper effluent regulations are administered in a way which takes into account the social economic welfare of those dependent on the industry for a living. It is a reason why the existing federal effluent regulations were established on the basis of a tiered system of enforcement to allow older mills in the country more time to achieve the necessary discharge reductions. It also is the reason why there is a need for federal participation in regulating the industry to ensure that residents in all parts of Canada have an equal opportunity to share in the benefits from industry, without long-term deterioration in the global and national environment.

The need to take into account the social economic welfare of those who depend on a mill operation for a living is not without foundation. The overwhelming importance of the industry to the economic prosperity of many regions and communities within Canada is without question. However, the Canadian pulp and paper industry is not balanced on the edge of economic devastation, nor are the benefits generated by industry provided without considerable support by government. Industry is comprised of large powerful companies and firms which have considerable resources. Of the approximately 82 pulp and paper firms operating in

Canada, fifteen are among the top 100 pulp and paper producers in the world. Eleven of the Canadian pulp and paper companies are included in the top 100. In 1985, five companies accounted for 26 percent of the total daily domestic production of newsprint, 56 percent of the marketable pulp and kraft paper production, and 12.5 percent of other pulp and paper products. Seven companies, including Donohue and Domtar, accounted for 42 percent of the total average daily production of the industry during 1985, and 63 percent of the production of marketable pulp and kraft paper. These companies may not be considered gigantic by world standards, they nonetheless are large and powerful companies with considerable assets.

The pulp and paper industry unquestionably provides many benefits for Canadians. However, these benefits are not provided without considerable support by government and the Canadian people. The industry's existence is critically dependent on the use of publicly owned forestry resources. Over the five year period 1984 to 1989, the provincial and federal governments will be spending about $1.09 billion upgrading the nation's forest. Pulp and paper manufacturers use about 35 percent of Canada's total annual forest production. The pulp and paper industry is the largest industrial user of water, and the second highest industrial user of energy. The industry pays royalties and fees for the use of these resources (as do other industrial users), but it also pays the lowest marginal tax rate on income and capital in Canadian manufacturing. The pulp and paper industry certainly is not a government dependent industry, but neither is it an industry that does not benefit substantially from operating in Canada.

The presence of large and powerful companies in the industry does not necessarily mean that every company and mill in the industry can achieve the same level of effluent reductions with equal ease. Neither does it mean that larger companies will always be in a position to adopt environmental safeguards during every phase of the business cycle. The industry does experience periods when the imposition of environmental controls can place a burden on company resources. There are many small firms that find it difficult to match the environmental control efforts of the larger companies. However, just as the existence of large and powerful companies does not mean that all mills are in a position to immediately adopt the necessary environmental controls, neither does the existence of small firms necessarily imply that individual companies are unable to achieve loadings reductions commensurate with the standards specified under federal effluent abatement regulations.

The pulp and paper industry is comprised of numerous mills, which have operated successfully over many years. Despite this general success, there are many who tend to overestimate the potential for mill closure. Mill closure is both overstated as a problem relating to environmental controls, and misunderstood as an unavoidable reality of operating a business under competitive economic conditions. The economic welfare of a community or region seldom depends on individual ownership, even when a mill is the major or only employer in an area. If the conditions within a region are appropriate for operating a mill successfully over the long-term, the investment required to install pollution controls will not discourage others from taking advantage of the opportunity to operate a potentially successful mill operation. Regardless of ownership, mill operators will continue to pay taxes, earn foreign exchange, provide jobs, and pay salaries to local residents. In fact, new operators could be expected to improve production efficiency, and perhaps expand operations, as a result of bringing a new commitment to the ongoing success of a previously economically tenuous facility. If the situation is such that a mill cannot be used to make a contribution to the economic success of an overall operation, and will not make a profit regardless of ownership, it will permanently cease operation. There is absolutely nothing government can do by way of concession or subsidy, short of outright purchase of the mill and perhaps providing additional timber tenure rights, to alter the fact that such a mill will eventually close.

The general tendency to overestimate the negative impact of environmental controls on industry inevitably results in enforcement procedures which benefit the less efficient mills. Under such circumstances, government is in effect subsidising the inefficient operator at the expense of those who are efficient. Not only does this discourage efficient mills from adopting the necessary environmental controls, because of what they might consider a penalty for being efficient (and perhaps large), but also encourages the inefficient allocation of capital and resources within the economy. Those mills that cannot operate on a permanent bases without government assistance, should be allowed to cease operation for the good of the industry and the health and prosperity of the nation. This does not mean that government should be callus or insensitive to those who depend on a mill operation to earn a living. It is to suggest that concessions made on the basis of the unrealistic perception that pollution controls may force closure of an otherwise economically viable pulp mill operation, poses a long-term threat to the international competitiveness of the industry. The number of long-term secure jobs in the industry depends on domestic and international competitiveness, and in turn, on efficiency. Environmental regulations should not be enforced on the basis of the least efficient operations.

There is a great deal of heterogeneity in the cost structure of the industry. Consequently, general pronouncements on the ability of industry to make expenditures on pollution controls either under or overestimate the situation for individual mills. However, when taken in aggregate, it is possible to determine whether industry can afford to meet the pollution control standards specified by the Federal Government. When the upper limits of pollution control expenditures are assessed in terms of increases to unit cost of production, and the prices paid in the marketplace, it is possible to predict the economic impact of environmental controls for most mills in the industry. The calculations provided in this Chapter indicate that the total additional cost for installing the latest in available effluent control technology in a newly constructed 1,000 tonne per day kraft mill most often will represent less than 5.8 percent of the total capital investment. The cost of incorporating the latest in effluent control technology into the construction of a new CTMP mill that produces 600 tonnes of pulp per day most often will be less than 9.2 percent of the total capital cost of building such a facility.

A deliberately high estimate of the total per tonne cost of installing an aerated lagoon in a 1,000 tonne per day kraft mill already operating in the industry, without taking into account the cost of land or tax depreciation allowances, is about $13.90 per tonne. This represents about 1.8 percent of the expected average price for a tonne of softwood kraft pulp in the United States market during 1988. A similarly high estimate for adding an aerated lagoon system to an existing 600 tonne per day BCTMP or CTMP mill is $12.80 per tonne. This represents about 3.3 percent of the current price paid for BCTMP pulp in the United States market.

The impact of adding $14.00 per tonne to the total cost of production should not be underestimated, neither should it be overestimated. It can be argued that cost estimates which are compared with current record high market pulp prices provide a distorted picture. This certainly would be true, when such comparisons are used to assess the impact of cost production increases on industry over a ten year period. However, it should be noted that as prices rise through time, the significance of a single fixed cost of production increase (assuming a constant interest rate) declines. When a fixed increase of $14.00 is taken as a percentage of the average 1983 cost per air dried tonne of production at the mill level, it would have represented 3.5 percent of the unit cost of production among eastern mills, 3.8 percent among British Columbia interior mills, and 3.3 percent among British Columbia coastal mills. This same comparison with the average 1986 mill level production cost would have represented 3.4 percent of the unit production cost among eastern mills, 3.9 percent among British Columbia interior mills, and 3.4 percent for British Columbia coastal mills. When these cost estimates are examined in light of the very substantial changes in factor input costs that take place within the industry over time, and the more than $150 per tonne difference between the top and bottom of the cost curve for pulp production in North America markets, it can be safely concluded that the cost of installing a secondary biological treatment system can be accommodated by most mills in the industry without threat to competitive position.

The cost estimates for an existing 1,000 tonne per day kraft mill and an existing 600 tonne per day BCTMP mill do not include within them provision for the economic advantages which can be achieved through the combined adoption and installation of mutually supportive production and effluent control process systems. In other words, the calculations are based on a single separate addition of an aerated lagoon system, which greatly exceeds the average cost estimates provided by four engineering firms with experience in installing treatment systems in pulp and paper mills throughout the world. Therefore, it can be safely submitted that most mills currently operating in the industry could put in additional environmental safeguards over and above the secondary treatment systems included in these estimates for approximately $14.00 per air dried tonne of production. Most mills in the industry could install the latest in available effluent control technologies without seriously impairing the economic viability of their processing operations.

The economic costs of pollution control measures varies with the type of pulping process used at a mill. Over an identifiable range of loadings reductions, all mills in the industry can make incremental improvements in environmental performance at minimal or no cost. Once these initial reductions have been achieved, further reductions cannot be achieved without major, and often expensive, changes to existing operations. Many mills in Canada have reached a point where further advancements in effluent controls cannot be made without major investments on particular types of controls. However, the overall cost of adopting the necessary controls can be reduced through the use of a planned systematic approach, which is staged so that the reductions achieved in each successive phase builds on the accomplishments made during previous phases. Over the long-run, operators of otherwise economically viable mills could achieve targeted level of loadings reductions without threat to economic viability to their ongoing operations. However, as indicated by the information presented in this Chapter, most mills in the industry do not use a consistent systematic approach for investing in pollution controls. The tendency within industry is to spend large amounts of money on expanding production capacity, while at the same time reducing the overall level of expenditure on pollution controls during economic buoyant periods. This pattern of expenditure not only demonstrates a lack of commitment by industry to meet government standards, but adds immeasurably to the difficulty of bringing the industry into compliance over time.

Government sensitivity to the financial circumstances of industry, together with the legal uncertainties inherent in applying the regulations, contributes to a situation whereby cyclical fluctuations and economic conditions within the industry provide individual mills with ample opportunity to avoid making expenditures on pollution controls. In an effort to avoid causing economic hardship within industry, and at the same time avoiding some of the legal difficulties associated with identifying expanded and altered mills, government officials enter into negotiations with individual mill representatives. During economic downturns, all mills experience some economic difficulties, and understandably many would find it difficult to adopt the control measures deemed necessary. The ability of individual mills to adopt environmental safeguards during economic lows practically always is made more serious because of increased competition due to additions to production capacity during the previous upswing. Under circumstances where government officials are willing to make concessions in response to claims of economic hardship without valid supporting evidence, mill representatives merely have to point to the current poor economic conditions within the industry during downturns in the business cycle. When conditions improve, mill representatives are in a position to claim any of a number of reasons to avoid installing additional safeguards. Mill representatives sometimes contend that mill modernisation and the upgrading of processing operations will reduce waste discharges, and control measurement should wait until the need for such controls in their upgraded facilities is proven absolutely necessary. They sometimes demand biological assessments and treatment studies to support the need for controls. Mill operators can agree to install the controls at a later date, because negotiated agreements are not proclaimed in law and such agreements can further weaken the government's ability to pursue further reductions through the courts. The overall consequence of this pattern of negotiation is that industry has been able to exert considerable influence on government enforcement efforts in the pulp and paper industry.

Under circumstances where government enforcement efforts can be influenced by industry, company and mill representatives can be expected to vigorously resist adopting environmental controls. It can be anticipated that there will be pressure for individual mills to act in accordance with what is perceived to be in industry's best interest. The economic advantages associated with resisting effluent controls are clear. The longer the industry can delay the installation of controls, the longer and more readily available money is for other more lucrative investments. The last mill to invest in abatement controls will enjoy an advantage over other mills who already have met government standards. Therefore, claims of economic hardship are understandable, because investments on pollution controls can put a mill at a disadvantage with other domestic competitors, unless all industry is required to meet the same standards within a preset time-frame. Claims of economic hardship also help reinforce the perception that mills within the industry are almost never in the financial position to make the necessary investments. Unfortunately, concessions which are made to individual mills on the basis of arguments of questionable economic merit, provide further incentive for other mills to avoid investing in pollution controls. Consequently, the enforcement procedures which have evolved out of government concern for the economic circumstances of the industry, have resulted in administrative processes which of themselves limit or prohibit progress in bringing the total of the industry into compliance with the effluent standards specified under federal regulations.

Changes to federal regulations and amendments to existing standards are not undertaken unless the proposed changes are discussed with industry representatives. This would seem appropriate given the implications that such changes can have on industry. However, the uncertainties associated with defining existing and expanded facilities, combined with differing legal interpretations of the regulations, results in the need to negotiate with individual mills. This dual level consultative process has resulted in negotiation patterns, which are inconsistent and inappropriate to the enforcement of minimum standards, which were specified on the basis of the control and treatment technologies available in the early 1970's. If individual mill negotiations were intended for reasons other than to assess the time needed to comply with the standards set out under the regulations, then it would not have been necessary to adopt standards based on technical criteria. In fact, it would not have been necessary to set regulations. Negotiations with individual mills could be undertaken as part of the more general provisions included under Section 33 of the Fisheries Act. If federal regulations were applied to all mills in the industry on an equal footing (provisions for existing, expanded, and altered mills were eliminated) and the industry could be encouraged to invest in environmental controls when the funds are most readily available, total compliance with federal standards could be readily achieved.

Although government assistance programs are not endorsed by all components in the pulp and paper industry in Canada, there are many who believe that government effluent control requirements place domestic producers at a disadvantage with the "heavily subsidised foreign competitors". The information presented in this Chapter refutes this argument. The industry's economic competitors have not benefitted to any greater extent from government assistance than have domestic producers. The Swedish and Finnish manufacturers of pulp and paper receive less government assistance than their Canadian counterparts. Furthermore, the more generous Canadian government assistance programs often stimulate only modest, and sometimes imperceptible, investment on pollution controls. The popular and relatively inexpensive CPAR program, which was designed to encourage research on pollution control technology, was the most effective pollution program supported by the Federal Government. The ACCA program may have encouraged some investment on pollution controls prior to 1972, when only investments on pollution controls could be depreciated at an accelerated rate. The multi-purposed modernisation program appears to have encouraged some investment on pollution controls among some regional components of the industry. As a result, it probably helped upgrade the overall environmental performance of the industry. However, the level of investment on pollution controls within the industry appears to have actually declined during the period the PPMP was in operation. The analysis carried out in this Chapter suggests that each government pollution program should have a clearly specified single set of objectives, which are administered solely for the purpose of controlling pollution. CPAR and the pre-tax reserve system adopted in Sweden appear to most appropriately typify the type of government assistance programs needed for dealing with the pollution problems in the pulp and paper industry.

The analysis undertaken in this Chapter clearly indicates that much remains to be done to bring the national environmental performance of the pulp and paper industry to a level commensurate with the effluent discharge requirements of the Federal Government. This should not be interpreted as criticism of industry or government. The considerable progress made during the early years, subsequent to the establishment of the pulp and paper effluent abatement regulations, attest to the important contribution of the Federal Government. Each of the provincial governments enforce standards either in cooperation with federal environmental officials, or independently, which help ensure that individual mills operate with regard for the environment. Some provincial requirements are more stringent than federal standards, and some are not. Nonetheless, provincial requirements almost always cover a broader range of pollution control parameters. The industry has done much to reduce the amount of disruptive waste released into the atmosphere and aquatic systems. Industry is currently undergoing dramatic changes in pulping processes; the corporate structure of the industry is changing. These changes will result in more efficient and less environmentally disruptive manufacturing operations. These very major changes in the composition and structure of the industry provide government with an unprecedented opportunity to set the level of environmental performance for the industry into the next century. Much depends on whether government responds in a fashion which clearly indicates what is expected of industry in terms of meeting their obligations to protect the right of Canadians to live in a clean environment.

It is difficult to overstate the importance of having firmly established rules, which apply to all mills within the industry. Companies cannot be expected to voluntarily adopt pollution control measures, which are disruptive to their ongoing operations and place them at a disadvantage with their competitors. Uncertainty with respect to government intentions detract from the planned and phased installation of environmental control systems. It adds to the cost of industry having to meet environmental controls over the long-term. It helps to foster capital investment patterns which are inconsistent with bringing the industry into compliance. Mills do not make expenditures without diverting money from other, practically always more lucrative, investment alternatives. It is difficult to justify investments on environmental controls which provide low or negligible returns, when the obligations on industry are unclear. Directors on the boards of companies have to justify investment decisions to their stockholders, company executives have to justify their expenditures to boards of directors, and mill managers have to justify their expenditures to corporate executives. The vast majority of the mills would have little trouble meeting government standards if the uncertainties associated with the enforcement of regulations were eliminated and all of industry had to meet specified discharge limits at a realistically established point in time.

CONCLUSIONS AND RECOMMENDATIONS

The historical growth and development of the pulp and paper manufacturing in Canada reveals much about the patterns which influence the environmental performance of individual mills operating within the industry. Canada's first paper mill was built in 1803. Over the next 43 years a series of small facilities were built in Upper and Lower Canada so that by 1851, there were a total of ten mills. Up until approximately 1840, all of the paper made in Canada was produced from rags. With the development of wood pulping techniques, Canada with its abundant forests and its extensive waterways began to produce pulp from wood. By 1851, the industry in Canada comprised of 21 mills which employed 760 workers. At the turn of the century, the industry had 6,286 employees working in 53 mills producing paper for mainly newspaper outlets which served small local domestic markets. Over the thirteen years between 1900 and 1913, governments in Canada passed a series of legislation that prohibited the export of pulpwood. During this same period, the United States eliminated tariffs on imported paper. The combined effect of the embargo on the export of wood, and the lowering and eventual elimination of tariffs gave rise to an industry, that by the outbreak of World War II had grown to 106 mills, which together produced 70 percent of the newsprint consumed in the United States. The pulp and paper industry in Canada had become the nation's leading industry. However, it also was an industry that had staked claim over a vast amount of forest and water resources. Continued availabilty of good quality forest and water resources, which can be accessed at reasonable cost, remain the most crucial factor in determining the overall success of each individual mill operating in the industry today.

The pulp and paper industry is presently comprised of 149 mills which directly employs roughly 70,000 people. It remains Canada's most important manufacturing sector. Pulp and paper manufacturing stands first among all Canadian industry in terms of value of production and total wages. It is second only to automobile producers in value of exports. It ranks third in value of shipments, and is amongst the top four in total capital. It is located in nine of Canada's ten provinces. Although a major employer in many regions with fairly large populations, it is most critically important in rural or remote areas. About 90 percent of the industry's manufacturing capacity is located in towns or cities of less than 100,000 people. Nearly 50 percent of its production capacity is in communities with populations of less than 10,000. It is the major or only source of employment in about 175 communities, which together have combined total resident populations of approximately 250,000. Between 275,000 and 300,000 jobs are directly or indirectly provided by pulp and paper manufacturing. It is a world class industry which is largely Canadian owned. The pulp and paper industry has made some positive contribution to the lives of every Canadian over most of this century.

The factor input requirements of the industry make it one of the largest consumers of goods and services in the nation. These major consumption requirements add substantially to the economic growth and prosperity generated by the industry. These requirements also make pulp and paper manufacturing a very serious potential threat to the environment. The industry uses about 35 per cent of Canada's total annual forest production. It is the largest user of water in the nation. It is the second largest industrial user of energy. It is a very large user of chemicals (it is estimated to use over three million tonnes of chemicals each year).

The heavy demand that industry places on the nation's resources has a wide variety of environmental implications. The harvesting of forests results in resource conflicts with other users. Tree cutting operations can cause soil erosion, and upset the fragile natural balances required to sustain fish and wildlife populations. The emissions from mill manufacturing operations detrimentally affect air quality within confined or limited geographic areas, and can cause odors which are distinctly unpleasent over a distance of about 50 to 100 km. However, the most serious environmental problem from the industry's operations is its impact on water. Water is used by the industry for transporation, storage, processing, and to discharge waste. This also results in user conflicts, but even more importantly, it leads to water contamination. The effluent from pulp and paper mills lowers oxygen levels, disseminates non-filterable residues, and adds both known and unknown compounds into receiving waters. These compounds often have an adverse effect on aquatic organisms and fish. If present in sufficient quantities, some of these compounds can be lethal. As a consequence, pulp and paper manufacturing is considered one of the nation's most environmentally disruptive industries. According to government authorities across Canada, pulp and paper manufacturing ranks first as an environmental problem in New Brunswick and British Columbia. It ranks second in Newfoundland, and third in Quebec, Ontario, and Manitoba.

Like most other industries, the pollution problems caused by the pulp and paper industry result directly from the production processes used in its manufacturing operations. The most difficult pollutants to control are from the pulping processes used to liberate fiber from wood and from bleaching. However, all processes and process phases generate wastes which are potentially environmentally disruptive if not controlled.

The broadest practical distinction that can be made among the various processes and process phases is between chemical and mechanical pulping. Total suspended solids (TSS) from mechanical pulping are usually greater than from chemical pulping. Nonetheless, both types of pulping processes generate TSS, and the actual amount of TSS loadings that occurs relates mostly to the efficiency of the equipment used to remove solids. Biochemical oxygen demand (BOD) is less of a problem in the higher yield mechanical processes than in chemical pulping, because the major source of BOD is the escapement of spent liquor. Therefore, the efficiency of the chemical recovery system has a substantial bearing on the amount of BOD released from a mill. The major non-volatile toxic compounds generally are present in both of these major pulping categories. Except for those substances emanating from the bleaching plant, the specific problems associated with toxicity depend on the type of wood being utilised, rather than on the properties intrinsic to the processing technologies employed. There exists no single environmental control or treatment that has consistently solved the toxicity problems of pulp and paper mills. The use of biological treatment either alone or in conjunction with other controls and treatments can be used to lower toxicity to acceptable levels. Most known hazardous wastes can be controlled to acceptable levels (except total reduced sulphur kraft mill emissions and colour) with current and available technologies.

It is often argued by those familiar with the industry, that there is sufficient economic incentive for the industry to reduce waste loadings to ensure responsible environmental performance without government regulation. The information and analyses presented in this report indicates that there are economic advantages for improving production efficiency by reducing material requirements, and consequently reducing effluent and air contaminant discharges. There are economic advantages for using waste materials to manufacture by-products (this is not true for air emission waste materials). Industry benefits from having access to a healthy forest base and good quality water supply. There is strong motiation for individual companies to continually improve environmental performance to foster a better corporate image, help raise capital, attract new employees, and reduce labour-force turnover. However, the industry's main responsibility is to its shareholders. Those products preferred by consumers, and as a result command the highest prices in the marketplace, also usually are the most environmentally disruptive to manufacture. A good corporate image does not depend solely on a firm's attitude towards the environment. Poor environmental performance does not necessarily mean that a company is a poor corporate citizen in the eyes of its shareholders. The general public does not always understand the consequences of poor environmental performance by an individual company or mill, but investors readily recognise poor profit performance on the balance sheet. Therefore, the benefits which can accrue to a company from reducing pollution only infrequently outweigh the disadvantages associated with the loss of competitive position or diverting capital away from more lucrative investments. Unless the environmental obligations for all companies and mills in the industry are clearly established, the industry cannot be expected to voluntarily adopt air emission or waste discharge controls.

The problems associated with regulating an industry as large, locationally diverse, and complex as the pulp and paper industry are enormous. The difficulties associated with adopting particular types of environmental controls differ according to the production methodologies employed, the economic circumstances of the individual company, and the construction and configuration of a mill. The type of wastes generated vary according to process, and the number of sequences and production phases used to produce different products. The tolerance of water and air to absorb wastes varies according to location. Perceptions about the need to protect the environment vary regionally, and with personal preference. The economic importance of the industry varies in each to region. As a result of these differences, there is a considerably amount of debate over the type of regulatory regime that best serves the interests of Canadians. On the one hand, there are those who believe that all mills should have to meet certain national standards of performance, regardless of mill location. On the other hand, there are those who claim that mills should have to adopt only those controls where the expenditures can be justified on the basis of measurable impact on the environment. It has been determined that there is merit to both sides of this debate, but there also are very substantial disadvantages to using one approach to the exclusion of the other.

The regulative arrangements that perhaps come closest to being justified in terms of protecting the environmental interests of the public and the concerns of the industry is one that utilises some aspects of both the national and regional approaches. The use of national standards may not result in an ideal world, but neither does an approach that deals only with local environmental impacts. National performance standards at least have the advantage of providing some level of protection for every Canadian from the environmental excesses which can occur. It is not in the national interest to set industry-wide standards which result in importing pollution from other countries. Neither is it in the national interest to adopt standards which threaten the industry's competitive position. The use of regional criteria to formulate discharge limits suited to the circumstances of a mill ensures that individual components of industry will not suffer from adherence to overly rigid standards that are not appropriate to individual or local circumstances. The use of national standards ensures that all elements within the industry share in the cost of reducing pollution from pulp and paper manufacturing operations without disrupting competitive conditions.

Even though the Federal Government has been involved in controlling waste discharges from the pulp and paper industry since the turn of the century, it was not until 1970 that the specific authority necessary to allow for industry regulations were established through amendments to the Fisheries Act. As revealed at the time the amendments were brought before Parliament and the Standing Committee on Fisheries and Forestry, the regulations were not meant as "cure-alls" to solve all industries' pollution problems. The regulations were to be enabling insofar as they would allow federal environmental authorities to work with the provinces and industry to reduce pollution. The discharge requirements adopted by the Federal Government were to be technology based and subject to regular review and adjusted to changing circumstances. It was intended that the regulations would clarify a leadership role within the Department of the Environment (DOE) for controlling industrial pollution, which was appropriate to federal constitutional responsibilities. The regulations were to be applied uniformly nation-wide to prevent pollution havens. The standards specified under the regulations were to be minimum standards developed in consultation with the industry and the provinces. The industry was to assume a greater share of the costs and responsibility for protecting the environment. The new regulations were to be administered in a way which would take into account the financial burden on individual firms, the economic circumstances of the community or region where the production facilities were located, and the impact on the public.

Consistent with the intentions stated before Parliament and Standing Committee, a task force comprising of industry, provincial, and federal representatives was established to develop standards for regulating the pulp and paper industry. While the industry did not have direct say in the philosophy used to develop the standards or the timing of compliance, the regulations as adopted reflect a negotiated compromise between the representatives of the pulp and paper industry and the views of government.

Discharge limits were set for TSS, BOD, and acute toxicity. The allowable discharges were represented as numerical values, which in the case of TSS and BOD limits were specified for each of a number of component process categories. The task force recommended that the pulp and paper industry use internal process controls rather than depending on external treatments to reduce effluent discharges. The ultimate result was a set of effluent regulations which have two requirement standards, and three levels of compliance. The requirement standards are based on the distinction between existing mills, built prior to November 24, 1971 and new mills built subsequently. The three levels of compliance include a more stringent standard for new mills, a somewhat less restrictive target for older existing mills, and a standard somewhere in between the new and old for existing mills that undergo modification (altered or expanded mills). The standards are to be enforced on the basis of monitoring information gathered at individual mills. The requirements as adopted by government and enforced by Environmental Protection (EP) are based on what is referred to as "best practicable technology".

The same principles that were used to establish the effluent abatement regulations were later used to develop air emission guidelines for the industry. The choice of guidelines rather than regulations, reflects the different recognised responsibility of the federal and provincial governments with respect to air and water. The intention of the pulp and paper air emission guidelines is to prevent the deterioration of ambient air quality in support of provincial initiatives to control air quality. Once again they are minimum standards, that are meant to be applied uniformly across the country to avoid pollution havens. The air emission guidelines together with the effluent abatement regulations provide federal environmental officials with the tools necessary to work with provincial authorities to protect the environment from the total of the waste generated by pulp and paper manufacturers in Canada.

The analysis undertaken in this report indicates that both the regulations and the guidelines have been administrative successes. The goals of the pulp and paper effluent regulations have been achieved. The air emission guidelines serve the purpose for which they are intended. The program delivery mechanisms which are necessary to ensure continued results have been established, and for the most part, are working well. Over the fifteen years between 1971 and December 1985, the average daily production from the 122 mills directly discharging effluents into Canadian waters (direct discharge mills release effluents which are not municipally treated) has risen by 16,470 tonnes or by 31 percent. During this same period, average daily TSS loadings decreased by 21,000 tonnes or 62 percent, average daily BOD discharges declined by 1,360 tonnes or 40 percent, and acute toxicity releases decreased by 3,022 thousand cubic meters or 31 percent.

The acute toxicity reduction estimates, like the bioassay test used to determine loadings levels, are based on total flow or water concentration. Consequently, they are a valid measure of the effluent loadings reductions considered acutely toxic, but are not a valid indication of the degree of toxicity. Most mills within the industry have reduced the amount of water used in their processes since 1971. If the industry were presently using the same amount of water used back in 1971, it could be expected that the amount of effluent discharge which is acutely toxic would be considerably less than the daily average 3,022 thousand cubic meter estimate provided here. Similar to the effluent discharge reductions, the common air contaminant emissions have declined on a per tonne of production basis over the entire period 1970 to 1986. In all, the industry has reduced pollution quite considerably over the years since the federal regulations were introduced, and the TSS and BOD loadings when taken in total, are approaching the level necessary to achieve nation-wide compliance.

The pollution control accomplishments of the industry cannot be attributed solely to the regulative efforts of EP. Each of the provinces have adopted regulations and enforcement procedures which help facilitate better pollution control within the industry. The efforts of industry, and the procedures used in many mills, have been major factors in contributing to the overall accomplishments made in improving environmental performance. The federal regulations have helped to reduce administrative overlap between and among government environmental agencies. They have helped to clarify the respective roles of the two levels of government. They have helped to prevent the establishment of pollution havens, and thereby served to maintain an atmosphere conducive to growth and investment throughout Canada. The regulative procedures adopted by EP also have resulted in engendering a somewhat more cooperative relationship between government and industry. Despite views to the contrary, the regulations as they are currently specified, have been enforced in a manner which is fair to both the public and industry.

Both industry and provincial government agency officials willingly describe EP activities as being instrumental in bringing about the changes which were necessary for safeguarding the environment. More than 75 of the representatives interviewed in a survey conducted in conjunction with this study, indicated that governments (both federal and provincial) have contributed at least as much or more than industry to the progress which has been made. Over 70 percent of industry spokespersons volunteered that the EP has made a better or equal contribution with provincial environmental authorities and industry. Most provincial officials with environmental responsibilities for the industry indicate that EP made an equal or larger contribution than industry or the provinces. It would seem reasonable to conclude on the basis of these results, that both the industry and the provinces place considerable value on the contribution made by the Federal Government. The Federal Government, through the efforts of EP, has been a major factor in bringing about better overall environmental performance among pulp and paper manufacturers in Canada.

An admittedly cursory examination of the value received for money was made on the combined efforts of industry, the provinces, and the Federal Government. As a result of this examination, it has been determined that: (1) With capital and operational expenditures of approximately $180 million annually, industry is devoting substantial funds to controlling its own pollution. (2) The total operational commitment of the federal and provincial governments in controlling the pollution from the pulp and paper industry is appropriate to the importance placed on the industry as an environmental concern by government environmental authorities nation-wide. (3) The combined commitments of both levels of government have been necessary for what has been accomplished in the past, and it appears that both will be needed if further progress is to be made in future. (4) The Canadian public, especially that portion of the public which perceive environmental protection as a major focus of concern for government, are receiving good value for what appears to be a relatively modest amount of annual government expenditure.

Despite substantial progress in reducing effluent discharges, the level of effluent loadings varies considerably among mills. Performance varies both with respect to absolute loadings levels and in the reductions achieved over time. A breakdown of the distribution of production output, TSS, BOD, and acute toxicity among the 122 direct discharge mills was undertaken. This examination shows that high production mills are not always the highest loadings mills. It shows that many mills are performing well environmentally. It also shows that a few mills account for a very large proportion of the total effluent loadings. The level of loadings from individual mills varies with the size of production and according to the pulping processes used, but the effluent controls adopted appear to be the main determining factor in the overall level of reductions achieved for particular types of effluents. Although these distributional comparisons do not provide an entirely accurate picture of the level of discharge reductions that can be achieved by particular mill categories (because non-pulping mills are compared with mills with pulping operations), there is little doubt that the amount of effluent released by the industry could be substantially reduced if the highest loading mills were to achieve discharge levels commensurate with the remainder of the industry.

Environmental performance also varies substantially among regional components of the industry. Once again, regional performance varies both with respect to absolute loadings levels and in the reductions achieved over time. Mills in all regions increased production over the eight year period 1978 to 1985. However loadings levels reductions for TSS vary from a high of almost 56 percent in Ontario to a low of twelve percent on the Prairies during the same eight year period. Loadings reductions among mills for BOD vary from a high of 68 percent in the Atlantic region to a low of eight percent in British Columbia over the period 1978 to 1985. During this same eight years, Ontario mills achieved acute toxicity loadings reductions of 53 percent and Quebec mills achieved toxicity reductions of eleven percent. Low levels of loadings reductions are not always an indication of poor environmental performance, because mills in some regions have achieved loadings reductions in the past which result in smaller percentage loading decreases in subsequent years. Nonetheless, there is sufficient divergence among regional components of the industry to indicate that the difference between and among regions will grow in future, unless deliberate efforts are made by government to ensure industry adherence to some acceptable national norm of effluent discharge control.

Important in this regard is the fact that federal standards, which could be expected to prevent large variations in environmental performance among mills in different locations apply to an estimated 51 of the 122 direct discharge mills in Canada. Only eleven mills in Canada are clearly established as mills subject to the federal effluent abatement regulations by virtue of being built subsequent to November of 1971. The other 40 mills considered subject to federal regulations are either expanded or altered mills. There is considerable controversy about whether these mills can be considered expanded or altered. There is as well a number of other mills which might be considered expanded or altered. Nonetheless, of the 51 assumed to be subject to federal regulations, 35 or 69 percent are considered in compliance for TSS, 42 or 82 percent are considered in compliance for BOD, and seventeen or 33 percent are considered in compliance for toxicity.

Some inconsistencies become apparent when compliance amongst mills subject to regulations are compared with compliance among mills not subject to federal regulations. Of the 122 direct discharge mills in Canada, 75 or 61 percent are in compliance with federal TSS requirements, 96 or 79 percent are in compliance with federal BOD standards, and 39 or 32 percent are in compliance with federal acute toxicity requirements. The level of compliance for TSS and BOD is greater among those mills subject to federal regulations, than it is for other direct discharge mills which are not subject to federal requirements. However, the number of mills considered in compliance with federal acute toxicity requirements is actually higher among those mills not considered subject to federal regulations, than it is among those mills where federal regulations apply.

The federal regulations provide provincial authorities with the freedom necessary to adopt more stringent standards as appropriate. They help to clarify federal requirements for a mill under the strength of the Fisheries Act. Therefore, it is not surprising that both industry and provincial environmental authorities look favourably upon federal pulp and paper regulations and guidelines. However, on the basis of the examination undertaken in this report, it is not surprising that federal regulations also are subject to much criticism from both the public and industry. These criticisms are not without substance, but neither are they totally valid. There is a tendency in industry and among certain segments of the public to underestimate the problems associated with administering regulations which are designed to restrict or eliminate pollution, which at the same time must be enforced in a manner fair to both industry and those who depend on the industry for a living. There is a tendency to underestimate the problems associated with maintaining consistent even-handed enforcement of regulations across industry, when provincial environmental priorities are different in each region and what is expected of federal environmental authorities differs among provinces.

The discretionary powers as to when mills should be included under the regulations are appropriate to the intended purpose of ensuring that unnecessary hardship is not imposed on the public. However, they also cause controversy over how much time industry, and individual mills within the industry, should be allowed to meet the regulations. The altered and expanded mills categories, which were established to bring existing mills gradually under the regulations as growth takes place in the industry, are at best questionable in law. Although many mills which are considered expanded or altered have increased production well in excess of ten percent, these output increases usually take place over a period of time. Practically all mill modifications increase production efficiency, and result in a reduction of mill waste discharge. Therefore, it is very difficult to determine whether the modifications that have taken place are for environmental reasons. There are questions about the portion of the expanded or altered mills which should be subject to the regulations. The courts appear reluctant to accept mills as expanded until it can be proven beyond reasonable doubt that certain specific mill modifications have led to an increase of more than ten percent at a particular point in time. They appear reluctant to interpret the reason for mill alterations. With no clear date on when production increases actually take place, and on what particular alterations to a mill are made for mainly environmental purposes, it is very difficult to prove a mill either expanded or altered. As it currently stands, the obligations for industry to comply with the regulations have been substantially reduced because of uncertainty about what provisions in the regulations can be enforced under the law.

The use of compliance agreements suffers from similar difficulties. The negotiation of compliance agreements were intended as mechanisms for establishing the point in time when each mill would be required to meet federal regulations. These agreements are either negotiated directly with company or mill officials, or as deemed appropriate, endorsed by EP and included as part of provincial compliance schedules or control orders. At least in theory, the incentive for industry to enter such agreements is that adherence to the terms of an agreement renders a mill free from prosecution in return for a genuine effort on the part of mill management to reduce disruptive discharge. As the regulating federal agency, the advantage to EP is that it encourages industry to cooperate without imposing unnecessary hardship or having to resort to the courts. Provincial involvement in the negotiation of these agreements is not only consistent with what was intended when the regulations were first established, but helps to ensure the federal requirements imposed on an individual mill are consistent with the provincial standards. The problem is that compliance agreements have no force in law unless registered, and none have ever been registered. However, whether registered or not, once a compliance schedule is signed, any attempt by government to prosecute usually results in court decisions favouring mill operators, because of difficulties in interpretion under the law. Therefore, when mill operators fail to live up to the terms of an agreement, government officials often have little choice but to accept the often unsubstantiated claims of industry and renegotiate the extention of an agreement. Unfortunately, concessions which are made to an individual mill on the basis of arguments of questionable merit, discourages other mills from willingly making the necessary investments on pollution controls.

The discretionary powers implicit in the regulations also give rise to a considerable amount of unfair criticism. Those responsible for enforcing the regulations must take into account the financial circumstances of a company, and the potential impact on the community where the mill facilities are located. Those not directly affected by the enforcement of the regulations, and who often have a sincere regard for the environment, demand immediate action. Mill operators often claim economic difficulties, and sometimes indicate that mill closure will occur if government officials persist in their demand for further effluent reductions. As a result, those enforcing the regulations are often faced with the prospect that the enforcement of standards may detrimentally affect the economic viability of a mill and impose hardship. The quandary for those responsible for enforcement often is exacerbated by the fact that the effluent being discharged may not pose any immediate threat to fish, wildlife, or human health. Yet failure to proceed with prosecution, or an extention of the terms of a compliance agreement, often is perceived by certain segments of the public as industry having undue influence on government, or even a silent conspiracy between government and industry to circumvent the law. These critics are ignoring that government officials often decide against prosecution simply out of compassion for the hundreds and sometimes thousands of Canadians who could lose their livelihood as the result of overly zealous enforcement. They are ignoring the possibility that the discharges which are taking place may not pose any immediate threat to the environment. They are overlooking the possibility, that what they might consider arbitrary and inconsistent use of the law is merely the exercise of the discretion that was intended by political leaders when the legislation was first adopted.

Those responsible for drafting the effluent pollution abatement regulations recognised that industry-wide waste discharge reductions could not be satisfactorily achieved over the long-term, unless the regulations were subject to regular review as new technology advances took place and new information became available. Such review procedures would have helped to ensure federal standards would continue to be consistent with the changing circumstances within industry. They could have helped to avoid some of the legal and definitional uncertainties which have arisen over time. Such reviews also would have provided those who are responsible for negotiating compliance agreements with up-to-date information on what realistically can be expected of industry. While EP has attempted to undertake a review of the regulations on a number of occasions, none have been completed. This can be partially explained by the difficulties encountered when trying to reach consensus with industry and each of the provinces on what changes are necessary. It also can be partially explained by the fact that the majority of mills do not come under the regulations, and mills which are thought to be altered or expanded may not be found subject to the regulations by the courts. Therefore, the consultative approach that was adopted when the regulations were first established has not always worked to the advantage of federal environmental authorities when administering the regulations. The distinction made in the regulations among new, existing, altered, and expanded mills has helped to discourage if not prevent review and revision of regulations.

The role originally adopted by the Federal Government when the regulations were first introduced is as valid today as it was sixteen years ago. Both industry and provincial environmental officials share with federal authorities a concern for: (1) Maintaining minimum national standards which protect the right of all Canadians to a clean healthy environment regardless of where they live and work in Canada. (2) Protecting the right of all provinces to share equally in the opportunity to acquire new industry, as well as the growth and prosperity which is generated by pulp and paper manufacturing. (3) Ensuring that all companies and mills within the industry share equally in the obligation to reduce pollution without threat to competitive position or imposing economic hardship on those who depend on the industry for a living. As documented in this study, both the provinces and industry agree on the role of EP in carrying out these perceived obligations. Nonetheless, as has been the experience whenever amendments to the regulations are being negotiated with industry and the provinces, there are many different views on how these responsibilities should be fulfilled.

The adoption of the federal pulp and paper effluent regulations in 1971 marked a new era in environmental protection in Canada. For the first time, there were nation-wide targets for pollution reduction in the industry in Canada. As recorded in this report, the regulations resulted in some major improvements in helping the provinces and industry reduce the amount of waste discharged into Canadian waters. All the original goals of the regulations have been achieved, but the role originally established for the government with respect to the regulations is not being adequately fulfilled. This does not necessarily mean poor or inefficient management. This does not mean that the initial objectives established by the Federal Government were inappropriate, nor does it mean that the criteria established to enforce the regulations were ill-founded. What it does suggest is that the industry has changed over the past sixteen years. It does suggest that knowledge about the pollution caused by industry, and the types of procedures necessary for successful control of waste discharges from the industry, have changed with the passage of time.

The review and analyses undertaken in this report includes an examination of fourteen different areas of concern to the provinces, industry, and the Federal Government with respect to the existing and future effectiveness of the regulations. These are as follows: (1) The continued use of a regulative process which distinguishes among different categories of mills in the industry. (2) The utility of using informal compliance agreements as instruments for achieving specific levels of reductions within an agreed upon period of time. (3) The applicability of using technical standards. (4) Using technical standards in conjunction with biological assessments to promote fair and equitable enforcement procedures. (5) The need to adopt and maintain standards on the basis of proven environmental impact. (6) The impact of federal effluent regulations on international competitiveness. (7) Industry's collective ability to meet federal standards without affecting economic viability. (8) The implications of economic and market trends within the industry on government negotiating procedures. (9) The need for direct EP enforcement of federal regulations. (10) The use of government assistance programs to help industry adopt environmental controls. (11) Increased international awareness of the need to control pollution caused by industry. (12) The need for federal discharge limits over a broader range of effluent compounds. (13) The continued use of the Fisheries Act as the basis for regulating the industry. (14) The changing circumstances of industry and the implication of these changes on controlling pollution from pulp and paper manufacturers. The findings and recommendations for each of these areas of concern are summarised in what follows.

It has become increasingly difficult to enforce regulations which distinguish between new mills built after 1971 and the three categories of mills (existing, expanded, and altered) built earlier. The tiered system of enforcement which results from these four different mill categories benefits those not subject to the regulations at the expense of those required to meet federal standards. Companies and mills cannot be expected to voluntarily adopt pollution control measures, which are disruptive to their ongoing operations and place them at a disadvantage with their competitors. Industry cannot be blamed for their apparent lack of enthusiasm for meeting federal effluent standards when there is uncertainty with respect to government intention. Uncertainty with respect to government intention detracts from the planned and phased installation of environmental control systems. It adds to the cost of industry having to meet environmental controls over the long-term, and encourages individual mills to avoid adopting the necessary controls in order to achieve compliance. It also makes it difficult for mill operators to justify their pollution control expenditures to corporate executives. The problems associated with these uncertainties are reflected most vividly by one company official when he stated:

> If government wants industry to reduce waste discharges we will do it, but tell us what is required, treat everybody the same, and don't change the rules every ten minutes.

EP cannot be accused of changing the rules every ten minutes, but there are uncertainties that have arisen over time which result in inconsistencies. These inconsistencies contribute to uncertainty about government intentions with respect to applying the regulations to all mills on an equal basis. Recommendation #1. All mills in the industry should be brought under federal regulations and be required to meet federal standards over a period of not less than five and not greater than seven years.

Compliance agreements are valuable instruments for clarifying with mill officials the requirements of government and the time necessary to reduce waste discharge. They also help to ensure that federal and provincial discharge limits are consistent. However, the legal uncertainties which result from the use of informal agreements adds enormously to the difficulties of those required to enforce federal standards. This problem has become more serious with the passage of time. Recommendation #2. The legal authority for federal officials to enter into compliance agreements with individual mills, and to enforce the provisions negotiated in these agreements, should be specified in the regulations.

The TSS and BOD discharge limits specified in federal regulations are indeed minimal standards which are within the technical capability of all industry to achieve. The federal acute toxicity standard is not a minimum standard, because it remains the most stringent toxicity requirement applied to the pulp and paper industry in Canada. Neither is it stringent enough to ensure the protection of fish and fish habitat in all circumstances. The federal acute toxicity standard can be most appropriately described as the median lethal requirement, which can be used to provide a minimal acceptable level of protection from the waste generated by the pulp and paper industry nation-wide. The bioassay used to test for toxicity has predictive value and since 1971 has been adopted (not necessarily the same standard) by many different jurisdictions throughout North America. The continuous flow-through provision required in the test is desirable because it keeps conditions of fish exposure to effluent more or less constant. Nonetheless, the bioassay test depends on the concentration of toxic substance in effluent. The results from the test vary with the amount of pH in water. The standards used to test toxicity are not the same in all provinces. The use of different standards in each province (and even different standards among mills within the same province) together with infrequent testing results in making it difficult to determine when mills are operating in compliance with the federal requirements. Recommendation #3. All three effluent discharge limit standards currently specified in federal regulations are considered appropriate to accepted federal obligations and should be maintained. The TSS, BOD and acute toxicity test standards should not be relaxed. However, unless federal environmental officials are prepared to require all mills to install slow rate biological treatment systems in hope that such systems will offset the apparent distortions which occur as a result of reduced water usage, the toxicity standard should be amended to provide for a water allowance which is set according to each different pulping process used in the industry. The possibility of standardising the toxicity test requirement across industry and among provinces should be reviewed (possibly the Federal Government should consider accepting LC50 = 100 as federal test requirement).

Although the emphasis placed on technical based standards was appropriate to the circumstances which prevailed within the industry in 1971, the continued use of technically based standards also helps to discourage industry from willingly adopting the necessary environmental controls. The exclusive use of technical standards would continue to be appropriate if all effluent loadings from industry could be eliminated, or all mills within the industry could be expected to meet federal discharge limits over the same period of time. They would continue to be appropriate if the environmental impact on waste substances from pulp and paper mills were approximately the same in each location. However, high production mills are not necessarily the largest loadings mills. Large loadings mills do not necessarily have the greatest environmental impact. As noted above, the discharge control limits established in the regulations do not always ensure adequate protection for fish and fish habitat in all locations. Therefore, more stringent requirements may be needed for some mills in some locations. Some mills may require more time to meet federal standards than others. Consistent with the intent of the regulations when first adopted, exceptions on the basis of the circumstances at individual mills is permitted. Unfortunately, whenever exceptions are made to federal requirements, they appear arbitrary and inconsistent unless substantiated on the basis of established criteria. Established criteria would encourage better overall cooperation from industry. It would clarify what is required from industry by government authorities. It would contribute to better long-range planning within industry.

The uniform and equitable enforcement of regulations does not depend on having all mills using the same pulping processes and production phases meet the same waste discharge limits, but in requiring all mills within industry to achieve reduction levels which are appropriate to their environmental circumstances. It is not equitable to have two mills subject to the same discharge limits, when one is causing a disproportionate amount of damage to the environment and the other is not causing any apparent environmental harm. The minimum technical standards specified in federal regulations establish the maximum loadings acceptable, given the uncertainties that result from not being able to identify all the substances in mill waste or knowing all the impacts that these substances may have on the environment. The selective use of biological impact assessments can be used to discourage mills from locating in environmentally sensitive areas. They can be used to identify when the general provisions under Section 33 of the Fisheries Act might be appropriately applied. The information gathered from biological assessments can be used to establish criteria for the fair and even-handed enforcement of federal regulations. Recommendation #4. The selective use of biological impact assessments should be used to set criteria for validating and negotiating exceptions to the requirements specified in the regulations. Unless the waste discharge from a mill impacts detrimentally on fish or fish habitat, the use of discharge limits more stringent than those laid out in federal regulations should be left to provincial environmental authorities.

The wisdom of the decision to place emphasis on the use of internal controls, when the regulations were first established cannot be questioned. The use of internal controls has provided those subject to the regulations with the opportunity to undertake internal plant modifications, without having to endure immediately the very substantial cost of external treatments which may have eventually proven to be ineffective. It has allowed time for individual mills and companies to assess whether external treatments are necessary to control effluents from their individual facilities. It has encouraged a "clean mind set" within the industry by helping to establish, that effluent discharges are not acceptable and should be controlled within the factory fence. Unfortunately, it also has become clear through time that further loadings reductions cannot be achieved by some mills unless internal controls and external treatments are used in combination. The combined use of internal controls and external treatments provide mills with the opportunity to adopt the most efficient and effective blended use of the best available technology. Loadings reductions commensurate with federal regulations will not be achieved by all mills unless standards are enforced on the basis of prescribed limits rather than on a preference for particular technologies. This has become apparent to industry and accounts for some of the resistence to federal acute toxicity standard. The emphasis placed on internal controls also helps to dissuade some mill operators from adopting external treatments, when there is uncertainty about whether all mills requiring such treatments will be expected to adopt the same technologies when necessary. Recommendation #5. Federal environmental enforcement efforts should focus on having mills reduce their effluent discharges to the levels specified in the regulations, and not on choosing the type of control systems to be used. With a clear understanding of when industry will be required to meet federal standards, each mill will be in a position to adopt the most efficient and effective combination of controls and treatments for their particular situation.

There is a growing tendency within industry to demand that environmental controls be established, and standards be enforced, only in those circumstances where there is proven environmental impact. There is a growing tendency among industry officials to assume that government must prove the need to enforce standards specified in the regulations. This misunderstanding should be corrected. Industry should be advised that the obligation is on the individual mill to minimise the amount of environmental risk imposed on the public. The public is not obliged to accept environmental risk to protect industry. It is not in the public interest to set and enforce government standards solely on the basis of proven environmental impact, when environmental impact cannot be measured with precision. The amount of risk that Canadians are willing to accept to protect the industry is a decision which has to be made in the best public interest. Recommendation #6. Industry should not be allowed to determine when environmental assessments or treatment studies are necessary, unless the company or mill pays the full cost of such assessments and company or mill authorities are willing to commit to additional controls if the studies indicate that more stringent safeguards are required.

Canada is only one of 70 different nations to produce pulp and paper products throughout the world. Like most other nations that produce pulp and paper products, Canada sells its products in international markets. In most nations where pulp and paper manufacturing is a major industrial component, governments have found it necessary to place environmental restrictions on pulp and paper manufacturers. The approaches used to regulate pollution vary quite considerably among nations. The regulative procedures that are used vary according to the economic circumstances of the nation where the manufacturing operations are located, and with the perceived natural assimilative capacity of the receiving environment. The cooperative arrangements that have been established between the federal and provincial environmental authorities result in this same approach in Canada. However, the environmental regulations imposed on the industry in most countries are stricter than those used in Canada. This is the case for pulp and paper manufacturers in those countries which compete directly with Canadian pulp and paper manufacturers in international markets. The United States, Sweden, and Finland all have more rigid government imposed effluent control standards than those used in Canada. With the possible exception of a few mills in the United States, individual mill operations in competing countries receive less government assistance than in Canada. Except for the United States, the percentage of discharge reductions achieved are greater than they have been in Canada. There is no evidence to show that foreign governments subsidise their pulp and paper manufacturers to the disadvantage of Canadian industry. There is no evidence to suggest that foreign manufacturers have been able to meet more restrictive discharge limits because of government subsidies.

As documented in this report, the unit increase in cost of adopting the best in effluent control technology for a 1,000 tonne per day kraft mill would most often be less than $13.90 per tonne. This represents less than 1.8 percent of the expected average price paid for a tonne of softwood kraft pulp in the United States market during 1988. The cost of installing the best available technology for controlling acute toxicity in a 600 tonne per day BCTMP (bleached chemical thermo-mechanical pulp) facility would not likely exceed $12.80 per tonne. This represents less than 3.3 percent of the average expected price paid for BCTMP pulp in the United States market during 1988. The difference between a high cost pulp producer and a low cost pulp producer in the North America market during 1988 has been estimated at $180 per tonne. The cost of adopting the best in available effluent control technologies will not impact on the international competitiveness of any but the least efficient producers operating within the industry.

As a general rule, an efficiently operated mill generates lower effluent loadings per tonne of production, than those operating inefficiently. In circumstances where government enforcement procedures are geared to the least efficient operations, government is in effect subsidising the inefficient operator at the expense of those who are efficient. Not only does this discourage the efficient mill from adopting the necessary environmental standards, because of what might be considered a penalty for being efficient (and perhaps big), but also encourages the inefficient allocation of capital and resources within the economy. It discourages improvement in productivity, and as a result poses a long-term threat to the international competitiveness of the industry. Federal effluent abatement standards do not detrimentally effect the international competitiveness of the pulp and paper industry. However, government enforcement procedures which give advantage to inefficient operations can result in the deterioration in the competitiveness of the Canadian industry in world markets. To the degree that pollution controls reduce the amount of chemicals used in process, and encourage the more intensive use of input materials, they also help to improve plant efficiency and consequently international competitiveness. Recommendation #7. Once all mills in the industry are subject to federal regulations, any further concessions in terms of the time required to meet government standards should be established on the basis of the financial circumstances at the individual mill.

The cost of adopting the pollution controls necessary to meet federal discharge limits are not trivial. Expenditures on pollution controls almost always result in low or negligible returns even when specific modifications add to production efficiency. Companies or mills do not make such expenditures without diverting money from other, often more lucrative, investment alternatives. The costs associated with installing treatment systems can place a substantial burden on individual mills during periods of poor market conditions. However, the industry does not continually operate under poor market conditions. The deliberately high per unit cost estimate of $14 per air dried tonne would have added 3.4 percent to the average mill level cost of producing a tonne of pulp among eastern mills during 1986. It would have added 3.9 percent to the average 1986 cost of producing a tonne of pulp among British Columbia interior mills, and 3.4 percent among British Columbia coastal mills. When these incremental additions to unit production costs are compared with similar recent cost increases for other factor inputs at the mill level, the overall impact on the average mill cannot be considered overly burdensome. Neither can these additional costs be considered prohibitive in terms of achieving the necessary discharge reductions over a reasonable period of time.

Not all mills in the industry are 1,000 tonne per day kraft mills or 600 tonne per day BCTMP facilities. The unit cost of installing pollution control equipment varies with the size of the operation. Costs also vary with the circumstances of individual facilities. Nonetheless, the total cost of adopting pollution controls, and the ability of individual mills to absorb these costs, depends in large degree on those operating the mill. If the installation of effluent controls measures are planned as part of an overall investment program, and each incremental addition to plant effluent control capacity is staged so that it builds on what was accomplished in previous periods, the total cost of adopting pollution controls would be substantially reduced. There are economic advantages to adopting more than one treatment control process at the same time. There are economic advantages to adding treatments and controls as changes to production processes and phases are incorporated into a mill operation. If plant operators have not already undertaken internal modifications to reduce water usage and to collect and separate effluents, then the cost of installing biological secondary treatment will be correspondingly high. If internal modifications have been undertaken, the cost will be lower. To the degree that the cost of installing secondary treatment at an individual mill surpasses what can be perceived as the normal range of costs for other mills with similar production capacities and pulping processes, these costs often can be at least partially attributed to inadequate attention to the inevitable need for such controls in the past. In some cases there is reason to temper concern for individual mill operations with the knowledge that past omissions may contribute to the high cost of installing the necessary safeguards.

The pulp and paper industry experiences cyclical and secular fluctuations which inevitably result in high peaks and low troughs in economic conditions within the industry. There is a tendency within the industry to spend large amounts of money on expanding production capacity during buoyant economic periods, without making commensurate levels of investment on pollution controls. This pattern of investment not only demonstrates a lack of commitment among some mills within the industry to meet government standards, but adds immeasurably to the view that industry simply cannot afford to make the necessary expenditures on pollution controls. It contributes to a situation, whereby government officials tend to overestimate the economic impact of having to meet government environmental effluent discharge limits. These views are often reinforced by industry claims of economic hardship. This tendency to overestimate the economic consequences of mill operations, together with the uncertainties of knowing when a mill is expanded or altered, has led to negotiating procedures which tend to favour those wishing to avoid installing the necessary environmental controls. It results in concessions which are based on unsubstantiated claims of economic hardship and discourages other mills from willingly adopting the necessary safeguards. It engenders a disregard for federal standards, and gives rise to a considerable amount of criticism from both industry and the public. There is a need to prevent mills from indefinately delaying adoption of the necessary environmental controls because of what are most often temporary periods of economic vulnerability. There is precedent for companies to provide financial information for government review, as a result of the work undertaken as part of the Ontario Municipal-Industrial Strategy for Abatement Program (MISA). Recommendation #8. Companies and mills should be required to provide financial information for independent audit when they claim they cannot meet government standards for economic reasons. The results obtained from these independent audits should be subjected to economic analysis to determine the time needed by a mill to comply with government requirements. There is a need to make a distinction between financial analyses which are used to determine profitability and financial solvency on a balance sheet and the type of financial and economic analyses required to assess a company or mill's financial capacity to invest on environmental safeguards.

Federal environmental authorities have participated in a number of programs to help industry to control pollution. These programs were not meant to displace the efforts of industry in reducing their own waste discharges, but were designed to supplement the efforts of the individual mills so that there would be a consistent pattern of environmental improvement over time. These programs have had mixed results, and the effectiveness of each of the different programs does not always correspond to the perception of government officials. The Pulp and Paper Modernisation Program (PPMP) was the most expensive of these government programs, but was only limited to eastern mills (east of the Ontario-Manitoba border). The PPMP program, which was jointly funded and administered by federal and provincial governments, resulted in an estimated $55.8 million being spent on pollution controls within the industry. The Accelerated Capital Cost Allowance (ACCA) program appears to have encouraged investment on pollution controls prior to 1972, when the program applied to only pollution controls within the pulp and paper industry. However, the relatively inexpensive Co-operative Pollution Abatement Research (CPAR) program, which resulted in industry receiving $10.6 million over an eight year period to undertake research on pollution abatement controls, was the most successful in terms of encouraging the adoption of pollution controls within industry. It was the most successful program in encouraging a better understanding about the pollution problems of industry and helping to facilitate good cooperation between government and industry.

The success of the CPAR indicates that programs established to help industry improve their pollution control performance should be designed and delivered solely for the purpose of encouraging better environmental performance. The investment fund reserve system used in Sweden is an example of a government program that would help pulp and paper manufacturers help themselves to control pollution without direct financial assistance by government. An investment fund reserve system, which is tightly controlled to ensure that reserve funds are used only for the purpose of controlling pollution, would likely be more effective and less costly than the recently discontinued ACCA program. A fixed fund reserve program is ideally suited to an industry which experiences cyclical variations in economic conditions. Recommendation #9. If it is deemed appropriate to provide government assistance to help industry control pollution, consideration should be given to reinitiating CPAR, or establishing a fixed fund reserve system to encourage industry to spend their own funds on adopting the necessary discharge controls.

Federal environmental authorities depend to a very large extent on the provinces to enforce standards at least as stringent as those specified in federal regulations. Provincial effluent control standards vary quite considerably, and are not always as stringent as the standards set out by the federal government. Thirty-one percent of the 122 direct discharge mills in Canada have less stringent provincial TSS and BOD discharge limits than those specified in federal regulations. Although it is difficult to generalise about provincial acute toxicity requirements, it can be safely said that only a few mills in Ontario are required to meet the continuous flow acute toxicity requirement specified in federal regulations (assuming LC50 = 100 is equivalent to LC20 = 65). It is obvious from this that provincial environmental authorities are not always willing to enforce standards at least as stringent as those specified under federal regulations. The reasons for this are unclear. Some provinces have more rigid requirements for particular pollutants, while other provinces have less rigid requirements for these same pollutants. Therefore, the reason for less stringent standards in some provinces is not due to technical limitations. Neither can it be attributed to lack of cooperation. Some provinces do not have consistent control requirements among mills within their jurisdiction.

The provinces enforce regulations which cover a broader range of pollutants than federal effluent regulations. It would appear that this sometimes necessitates trade-offs, which result in less stringent limits for one type of pollutant in exchange for more restrictive limits on another, in order to achieve better overall environmental performance in certain mills. The environmental priorities of each province cannot be expected to always coincide with federal priorities. Nonetheless, the federal standards are minimal requirements, which the vast majority of mills in the industry should be able to meet without disruption to their operations. Recommendation #10. The so called "single window" approach used in some jurisdictions should not preclude the Federal Government from dealing directly with individual mills when necessary. This is not to suggest that the cooperative arrangements which have been established with environmental agencies in most provinces should not be maintained. It is to suggest that the Federal Government should be prepared to act unilaterally by exercising its legislative responsibilities, when necessary to achieve compliance with federal effluent discharge limits.

Although the very substantial importance of the pulp and paper industry in Canada convincingly underlines the need to tailor pollution control regulations to the economic circumstances of the industry and the environmental needs of Canadians, there are a number of practical considerations which indicate a need to place greater emphasis on international activities. The pulp and paper industry from its earliest days has been dependent on international trade for its existence. The international appreciation for the need to control pollution has increased substantially over the years since the regulations were first introduced. It has been observed that the number of national and environmental agencies involved in protecting the environment has grown from seven in 1972 to 113 in 1986. There appears to be growing interest among industry officials and provincial agencies for EP to monitor trends in pollution control technology both nationally and internationally. The consensus among industry and provincial environmental spokespersons is that EP should take an active role in maintaining some minimal level of environmental performance across Canada and at the same time ensure consistent, but not necessarily the same, standards of control between Canada and the United States.

The trend internationally is to recognise that the pollution control efforts of each country is an item in which all other countries have legitimate interest. This is particularly so when countries share common borders, are closely linked in trade, and the pollution from one nation impacts on the environmental quality of another. Although EP personnel currently place a great deal of emphasis on technology transfer between countries and keeping Canadian pulp and paper manufacturers abreast of the changes which are taking place internationally, there continues to be a considerable amount of misunderstanding about what is occurring in other countries. There are inaccurate claims about the amount of subsidies provided foreign competitors by their governments; there are unsupported claims about the poor efficiency of certain technologies which are extensively employed by foreign industry. Recommendation #11. The EP should continue to place a considerable amount of emphasis on working with the governments and industries of other nations to ensure that the latest information on pollution controls is available to Canadian industry.

Chlorinated organics which have been found in bleach kraft mill waste, have become an issue of international concern. Countries such as Sweden and Finland are placing a great deal of emphasis on controlling chlorinated organics substances. However, concern about these substances is not limited simply to Sweden and Finland. Organochlorines have become a major issue throughout the world. European countries have indicated their intention to restrict the import of pulp and paper products which contain organochlorines. Although there is limited knowledge about the impact of organochlorines on the environment and human health, they are known to be persistent and bioaccumulative. It has been estimated that about 200 of the roughly 300 different compounds found in bleach pulp mill effluent are chlorinated organic compounds. These bioaccumulative compounds enter the food chain through fish and fish prey, and therefore are of federal concern. Recommendation #12. The Federal Government should establish regulations to control organochlorines at the source. Either the Fisheries Act or the new Canadian Environmental Protection Act appear to be suitable vehicles for controlling these substances.

The use of the Fisheries Act as the legislative basis for enforcing industry effluent regulations poses some problems for those officials responsible for enforcement. This legislation is specifically designed for the purpose of fish management and carries with it the implication that the responsibility for the enforcement of pulp and paper effluent regulations should be divided in the same way as the enforcement of the Fisheries Act. The use of the Fisheries Act also serves to divert attention away from the more general responsibilities that EP has for the environment. However, it can be seen from the United States experience that a regulative approach which focuses on controlling individual substances results in extremely complicated and costly regulatory procedures. The regulative approach adopted in Canada is both efficient and effective when compared to alternatives. The general provisions under Section 33 of the *Fisheries Act*, which defines harmful discharges (including toxicity discharges) on the basis of impact on fish is appropriate to federal jurisdictional responsibilities and provides sufficient latitude to deal with the unpredictable consequences of discovering new harmful substances. The *Fisheries Act* is an appropriate vehicle for EP to use to coordinate the total of all federal environmental control activities as they relate to the resource and environmental responsibilities of other federal agencies. Recommendation #13. *The Fisheries Act should be maintained as a legislative basis for federal efforts to control effluent discharges from pulp and paper manufacturers until other legislative mechanisms prove to be at least as effective.*

The Canadian pulp and paper industry is currently undergoing the single greatest increase in production capacity since the ten year period between 1911 and 1921. There is a major shift in pulping processes which surpasses the similar, but somewhat less pronounced, shift to kraft pulping which took place in the earlier part of this century. The structure of the industry can be expected to change quite dramatically as a result. It can be anticipated that thermo-mechanical pulping, and perhaps other developing pulping processes, will dominate the industry in the not too distant future. The economic advantages of producing thermo-mechanical pulps are impressive. It is not only cheaper to build a chemi-thermo-mechanical pulping (CTMP) mill than a similar sized kraft mill, but fiber recovery is much higher. Canada with its increasingly valuable hydro-power assets, and the diversified forest lands, is in a good position to take advantage of the benefits from using this type of pulping. The recent record high profits of the industry have resulted in increasing the pace with which the industry is shifting to these new processes. It also has helped to stimulate a great deal of investment within the industry (estimated at roughly $6 billion over the next three years).

In the pulp and paper industry, buoyant economic periods are always followed by poor market conditions. The expansion which is taking place within the industry at present is causing many companies to position themselves to minimise risks and take advantage of the opportunities which will become available during the next economic downturn. Some companies are merging to consolidate their operations and achieve improved efficiencies. Some firms are moving rapidly into the production of higher value added products. Others are looking to acquire new assets and to increase the strength of their position within the industry. This will result in increasing the concentration of ownership within the industry over the next several years. It should help improve the economic performance of the industry over the next decade. Better economic performance combined with the advantages associated with manufacturing higher value added products, should result in a stronger more competitive industry. The very significant shift to new cheaper, less water demanding, and potentially environmentally cleaner thermo-mechanical processes will result in reducing the amount of disruptive effluents discharged by the pulp and paper industry. The amount of investment currently taking place within the industry, combined with increased concentration within the industry, provides government environmental officials with a opportunity to set the standard for environmental performance within the industry into the next century. Recommendation #14. Although it will take time to amend the regulations so that all mills are subject to the federal discharge control standards, the current standards should be immediately applied to effluent discharges from all mills which expand or alter. Federal discharge standards should be applied and enforced on the basis of the total of a mill's effluent, and not simply on the expanded or altered portion of these mills.

It has become apparent that the information available within EP on individual mills and the industry is inadequate, and what is available is not always in a form which can be readily used for analysis or to provide advice to senior government officials. There have been instances where the effluent discharge control problems at a mill have been an issue of concern for two decades or more. Without adequate records on what transpired in the past, government officials are not in a position to thoroughly examine all the problems which impact on a decision to allow a mill more time to meet federal discharge requirements. Recommendation #15. The information system on the industry should be upgraded. This can be partially accomplished through regular visits to mills and by gathering information from other agencies and departments (Statistics Canada) and even from trade magazines. Reports should be prepared by EP personnel whenever discussions with industry mill officials take place in the regions. Copies of these written reports should be sent back to mill officials for their comments. The comments and the report itself should be included in the information system. The type of data gathered should include information on the type of processes and production phases used, as well as the pollution equipment employed at each individual facility. It should also include biological information on the receiving waters according to mill location as appropriate, and data on the financial circumstances of the industry and each individual mill. Records should be kept on the federal and provincial discharge limits for each mill, the number of tests taken at a mill each year, and the compliance performance of each mill over some reasonable period of time.

In closing, it should be pointed out that EP is currently involved in a number of program activities which relate to the findings and recommendations contained in this report. There is a review underway on organochlorines. There was a pulp and paper mill discharge performance report prepared in December of 1987, which uses some of the same data and information contained in this report (received in July 1988). A pulp and paper regulations review was started in June of 1988. A regulations strategy document has been prepared as a result of this review. Over a number of years EP has been examining the toxicity requirements specified in the regulations. There continues to be a considerable amount of work in this area at present. With access to much of the material gathered and reviewed by EP personnel on organochlorines, it can be anticipated that the discussion and recommendations contained in this report on organochlorines will be consistent with the latest available information on these substances.

It also can be anticipated that the material contained in this report will add further to the earlier discharge performance report on the industry, and will be supportive of the recommendations contained in the new regulations strategy document. However, the same is not necessarily true about the toxicity recommendations that result from the analysis in this report. The toxicity problems caused by the industry are complex, complicated, and difficult to measure. The technical complexities associated with revising toxicity standards are such that specialists with experience and training in this area are required to determine how the necessary changes should be specified. Although the information and recommendations on toxicity presented in this report were discussed thoroughly with specialists with experience in this field, they are not meant to presume upon the work currently underway within EP. Nevertheless, it is hoped that the issues raised in the text of this report, will be taken into account when the final decision is made on the toxicity standard to be used in federal regulations. All the recommendations made in this report are considered appropriate to the circumstances that can be anticipated to prevail within the industry over the next decade.

APPENDIX I

DATA SOURCES

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The information contained in this report was obtained from three main sources. The more general information on the performance and trends within industry was obtained from Statistics Canada, the Canadian Pulp and Paper Association (in particular, the Annual Reference Tables), and the Pulp and Paper Research Institute of Canada. Information on the views and opinions of industry and those involved in industrial pollution control within the provinces was obtained in a direct survey of industry and provincial officials during the winter and spring of 1987. The information on individual mills was obtained from the Industrial Programs Branch of Environmental Protection in Ottawa. These data were gathered in cooperation with the regional offices of Environmental Protection and the provincial officials of each of the nine provinces where pulp and paper mills are located.

The sources used to put together the information contained in this report unquestionably are the most reliable available in terms of providing the kind of information that is required to conduct the analyses presented in this study. Statistics Canada is the single most authoritative source of general economic and social information in Canada. The Canadian Pulp and Paper Association and the Pulp and Paper Research Institute of Canada have been developing (often through original research), gathering, and publishing data on the manufacture of pulp and paper in Canada for more than 45 years. There is no better method of gathering the views and opinions of the executives, management, and workers employed in the industry than through a direct stratified survey of industry employees. Despite all this, it should be kept in mind that there are certain inherent limitations in the data that are used in this report. These limitations are partially the result of definitional differences, and differences as to precisely what or whom a particular data set represents. They also are due to unavoidable variations in the way that data are gathered and the problems associated with using general descriptive information for detailed analysis of specific aspects of a single industry. In some cases, it has been possible to refine, or otherwise, compile the information so that it provides an accurate picture, which does not mislead the reader. Such was the case when the Prices Division of Statistics Canada provided direct assistance in compiling price indices for calculating the constant 1971 annual cost to the industry for the raw wood used in production. In other cases, it either was impossible or impractical to achieve greater clarity through further refinement. The intention here is not to comment on the former cases, where refinements where possible and an examination of the references cited will allow the reader clear understanding of the methodologies employed in the analysis, but rather to focus on the latter cases where refinements were not possible and it is felt that further clarification may be necessary to avoid error in interpretation.

Information from Statistics Canada and Industry Associations

Statistics Canada gathers and publishes information on the industry according to a general category referred to as "paper and allied industries" which is further broken down into a subset identified as "pulp and paper mills". The pulp and paper mills category includes within it mills producing both mechanical and chemical pulps, and mills that produce newsprint and refined paper. However, it also includes paper converting establishments and insulation manufacturers, construction materials producers and the like. A random check of a list of all corporations included in the pulp and paper industry category for the Corporations and Labour Unions Returns Act (CLURA) data retrieval system revealed that there were a substantial number of firms that would not normally be considered part of the pulp and paper industry, if the terms were being applied as commonly used within the industry. It also was found, when using the Pulp and Paper Mills Catalogue 36-204, that there were certain inconsistencies as to when particular mills operated between one year and the next. Certain mills that operated each year for more than twenty years were included for some years reported on during the twenty year period and omitted for other years during the same twenty year period. These obvious shortcomings were rectified using data from the other sources noted above to provide somewhat more accurate information on mill operations and to identify the companies operating in what is generally perceived to be the pulp and paper industry.

Other important information from Statistics Canada which are used extensively in this report was taken from the Canadian Socio-Economic Information Management system (CANSIM) and from catalogue 61:207. The data from these sources is used to provide an industry profile on economic performance over time. The basic elements used to provide these data are the enterprises and corporations that operated in the industry during each reporting year. An enterprise is a corporate legal entity that comprises of one or more corporations. It is a family of corporations that together form a consolidated legal block with a single profit-and-loss balance sheet. A corporation is a joint stock company, cooperative, limited liability partnership or other legal unit that is recognised as a single business entity, which may or may not be part of a larger enterprise. As defined by Statistics Canada, an example of an enterprise would be Noranda Forest Incorporated and the companies within that legal entity would include James Maclaren Industries Incorporated, MacMillan Bloedel Limited, Fraser Incorporated and Northwood Pulp and Timber Limited. The corporation, MacMillan Bloedel in turn, owns and operates mills in Powell River, Port Alberni and Nanaimo, British Columbia, Masson, Quebec, and in Sturgeon Falls, Ontario.

While the definitions as applied by Statistics Canada are straightforward, they can cause confusion if the terms are interpreted as applied in common terminology. For example, a corporation whose single asset is a paper mill would generally be considered a single corporation. In most cases this would be true, but in the pulp and paper industry it is not uncommon to have a paper machine (often owned separately or jointly by a newspaper chain) incorporated separately even though it is located in a mill already established as a distinct legal entity. Under such circumstances, Statistics Canada's definitions would list the single mill as two separate corporations, even though the two corporations are in fact one mill, which operates as a single production unit. This in itself does cause some apparent data discrepancies, even though the overall accuracy of the information is good, and does not distort the analysis contained in this report.

Similar difficulties were encountered when attempting to combine Canadian Pulp and Paper Association data with information gathered from other sources. The Canadian Pulp and Paper Association (CPPA) makes liberal use of Statistics Canada information to report on the industry each year. They also document data that are gathered from individual mills which are owned by companies that are members of the CPPA. Even though the CPPA represents about 98 percent of the companies in the industry, not all companies are members of the CPPA, just as not all companies included within Statistics Canada's definition of a pulp and paper company are what might be generally perceived of as part of the pulp and paper industry. However, none of these obvious limitations necessarily distort the analysis being reported on in this document. The CPPA is an excellent source of consistent, accurate information on the industry. The information from Statistics Canada includes all of the largest corporations, and as appropriate, mills within the industry. The dominance of the very large pulp and paper companies (in what is generally interpreted as the industry) within the classification categories used by Statistics Canada assures accurate information that can be used with confidence for analytical purposes, even though direct comparisons of data from the two different sources may give the appearance of more serious discrepancies.

Information from the Direct Survey of Industry and the Provinces

In order to obtain accurate comparisons on the different perspectives of industry and the pollution control authorities in each of nine different provinces, a survey was conducted during the early part of 1987. The survey was conducted using two separate questionnaires: one for industry representatives and another for provincial officials. The survey was stratified so that it included companies and mills in each of nine provinces where pulp and/or paper mills are located (see Addendum). It was designed to include large companies with several mills, and small companies with only one mill. It included a cross section of mills using the major production processes, as well as producers of each of the main product lines manufactured within the industry. Those responding to the survey included executives, management staff, and supervisory personnel as well as technical employees whose ongoing work related directly to pollution abatement control. Provincial officials included in the survey comprised of Assistant Deputy Ministers, Directors of Industrial Pollution Control Programs and field operations personnel. In every case, interviews with the provinces included the senior person responsible for pollution control within the pulp and paper industry for that particular province. The surveys were conducted using personal interviews that usually included more than one representative of the participating company, mill, or province.

In an attempt to keep potential bias to a minimum, the same government personnel participated in the interviews for more than one region. One person was present for all the interviews, another was present for seven of the nine provinces visited, and another two individuals participated in the interviews in at least two provinces. In most cases, the interviews were carried out with local government (sometimes provincial officials) present to help clarify the answers of those being interviewed. In all but five of the interviews more than one person representing the company, mill or province was present to respond to the questions. Those interviewed in the survey were not given advance copies of the survey in an effort to ensure, as much as possible, that the opinions were the views of those being interviewed and consensus positions were not established in advance. Although the questionnaires were designed to obtain the views of the respondents to a specific set of information that would allow for accurate comparisons, the interviews were conducted in an informal fashion to allow those being interviewed to introduce new ideas, or to allow for variations in viewpoint on items that were not necessarily included in the original questionnaires. Sometimes these same items were introduced into subsequent interviews to test the level of concensus on that particular item among other respondents.

In each and every interview a brief description was given about the purpose of the study in which the information would be used. The intention of the survey was explained as part of the background on the original intent of the federal pulp and paper effluent abatement regulations. All respondents were assured that their company or government organisation would not be identified or associated with any comment or opinion. Those being interviewed were asked to provide frank, straightforward replies, that could be used to assess federal efforts for pollution control within the industry.

In all, the nine provinces having at least one pulp and/or paper mill were included in the provinces portion of the survey. The cooperation from provincial officials was excellent except in one situation where those contacted were not briefed by regional federal environmental personnel about the purpose of the meeting, and as a result only reluctantly answered a limited number of the questions included on the questionnaire. In all other cases, the provincial officials answered all of the questions and were willing participants in the interviews. Five of the nine provinces expressed the opinion that the survey was a good idea and welcomed the opportunity to participate in what they felt was a useful effort.

If the provincial interviews could be considered reasonably successful, then the industry portion of the survey would have to be considered an outstanding success. More than 75 different individuals were interviewed during the course of the industry portion of the survey. As shown in Table I:1, industry representatives of more than 50 different mills were included in the survey. This represented 41 percent of the total number of direct discharge mills operating in Canada. As shown in the table, a significant portion of the industry in each region of the country was captured in the survey.

A statistical analysis on the accuracy of the survey reveals that the 50 mills in the survey exceeds the 36 mills that would normally be required to provide a statistically acceptable analysis of the target population. Even though confidence limits have not been placed on all the answers obtained in the survey, it has been calculated that if the representatives of ten of the 50 mills were to share the same opinion from a

TABLE I:1

NUMBER AND PERCENTAGE OF REPRESENTATION IN INDUSTRY PROVINCIAL AGENCY SURVEY THAT ARE DIRECT DISCHARGE MILLS[1] - 1987

	Number of Mills	Number of Mills Included in Survey	Percentage Captured in Survey
British Columbia	23	11	47.8
Prairies	5	4	80.0
Ontario	28	12	42.9
Quebec	47	17	36.2
Atlantic	19	6	31.6
Canada	122	50	41.0

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[1] A direct discharge mill is one which discharges its waste affluent directly into a waterway without going through a municipal sewage system.

Source: Industry and Provincial Agency Survey, 1987.

choice of two different possibilities, the answer obtained would be a statistically accurate representation of the 122 direct discharge mills in the industry nineteen times out of twenty with an error of less than plus or minus one. In other words, it can be said with 95 percent confidence that representatives of more than 23 and less than 26 of 122 mills hold that same opinion. Chi-square tests also were carried out on a random basis to determine if there is a statistical significant difference between the answers given by respondents. These tests revealed that there is a statistically significant difference among survey respondents and their answers cannot be attributed to chance.

Information from the Industrial Programs Branch of Environmental Protection

The analysis carried out in this report depends heavily on the mill by mill waste discharge information that is gathered and compiled in the regions by both provincial and federal environmental staff. It also depends on the mill and product classifications that have been used in the report. Waste discharge data are forwarded to Ottawa periodically so that status reports on the pollution reductions in the pulp and paper industry may be prepared for public scrutiny (the most recent of these reports EPS1/PF/1 was completed in October, 1984). This somewhat more extensive document uses the same basic information to expand on the previous work in an effort to determine the combined performance of those whose efforts have contributed to loadings reductions and to develop alternatives for the future. In this regard a more critical examination of data was undertaken to ensure that the data systems that have evolved over the past fifteen years are appropriate. As a result of this examination, it has been determined that the approaches and the data used are appropriate for measuring the progress made in pollution reduction under the present administrative arrangements and the regulations (both provincial and federal) that currently prevail.

Nonetheless, there are a number of limitations associated with these data that should be kept in mind when reading the report. The first and most important of these limitations has to do with the limitations inherent in the manner used to apply the data. Most mills in the industry produce more than one product. The variations and combinations of different pulps and products produced are numerous, and can lead to data distortions. Only those mills which produce groundwood pulp are classified as groundwood mills in the report. If a mill produces any other pulp in combination with groundwood, it is classified according to the other type of pulp produced. The production levels attributed to each category were developed by apportioning the output according to available production records. These classifications, like all mill and product classifications which can be applied to the industry, almost certainly result in some inaccuracies. Nonetheless, the number of product and mill classifications deliberately have been kept small, and as simple as possible, to keep data distortions to a minimum. The product and production breakdowns were chosen as a result of examining several different systems of classification. It was decided that the categories used in the report best serve the analyses which are employed.

It is implicitly assumed that the types of discharges being measured represents the total of the waste discharge that is harmful to the environment. While there is no evidence to suggest that the total suspended solids (TSS), biochemical oxygen demand (BOD) and toxicity to fish information used does not represent the greatest preponderance of waste discharges generated in manufacturing pulp and paper, this cannot be proven with absolute certainty. It is known that the bleaching processes used in the industry generate cholorinated organics, but to the best of our present knowledge they are not present in sufficient quantity or concentrations to assess with certainty the consequences. Dioxins and other contaminants also emanate from the processes used in the industry, but there is insufficient information to assess their overall effect. Therefore, even though those data used in this report are appropriate given the present level of knowledge, this does not necessarily indicate that better knowledge about the chemicals and processes used in the industry will not result in the identification of other environmental problems in future.

Another important limitation results from our imprecise knowledge about the environmental effects of the effluents discharged by pulp and paper mills. Although not the fault of any government agency or industry organisation, the amount of biological data available on the effects of waste discharges is inadequate to determine precisely what impact TSS, BOD and toxicity loadings have on the environment. The true test of how government, industry, and society as a whole are progressing in protecting the environment is in how well our ecosystems and living resources are being protected. Some information on this is provided for British Columbia's coastal mills. Unfortunately, this information merely serves to underline the importance of having this information available for more rigorous analysis in the future. It also serves to demonstrate some of the limitations that have to be kept in mind when interpreting the results and findings contained herein.

There are as well some minor differences in the effluent waste discharge data provided by the regions. The BOD and TSS tests are conducted on a regular basis in all areas. However, the point at which the outflow samples are taken for testing varies somewhat. The point at which samples are taken for BOD discharges is not the same in all provinces. In most provinces the effluent being discharged is tested for TSS after it has passed through the primary clarifier and before secondary treatment. This is not true in either Alberta or British Columbia. In Alberta and British Columbia the samples used to test for TSS are based on total biomass discharge and are undertaken after secondary treatment. Since direct discharge mills in both Alberta and eleven of the 23 discharge mills in British Columbia have secondary treatment, this does make a difference to the TSS loadings reported on in Alberta and British Columbia. These differences should be kept in mind when direct comparisons are made with other provinces. However, they do not offset the accuracy of the mill compliance comparisons made between regions and jurisdictions.

The toxicity loadings as documented in this report are estimates calculated on the basis of the percentage of failures (that is the number of times a mill is found not to be in compliance) to the total tests taken for the most recent years in which the data are available. In other words, if a particular mill failed its toxicity test four out of six times during 1984, and no tests were taken in 1985, then it is assumed that two-thirds of the discharge flow is toxic to fish. Mills which passed at least one test in the most recent years during which tests were taken, are considered non-toxic unless they have at least two subsequent failure tests. This reduces the possibility of overestimating the amount of toxic discharge from any particular mill or region. The reader should refer to the discussion in Chapter Five for further information on toxicity.

In most cases toxicity information is based on data gathered by the provinces. Toxicity requirements in each province varies somewhat. Therefore, it is assumed that LC50 = 100 (i.e. 50 percent of the fish die in 100 percent effluent after 96 hours) is equal to the federal agreement of LC20 = 65 (i.e. 20 percent die in 65 percent effluent after 96 hours). This would appear a reasonable assumption based on the information available in the literature (Walden et al., 1975). However, some tests in some regions are conducted using criteria less stringent than the LC50 = 100 and the LC20 = 65. This is true in British Columbia, where the provincial standards are used to determine federal compliance. Provincial authorities in British Columbia have different requirements for different mills depending on the waste discharge permit for the individual mill. Most of British Columbia's coastal mills have a LC50 = 30 requirement, one has a LC50 = 80, and another a LC50 = 13. All interior mills have a LC50 = 90 requirement except two which have LC50 = 10 and LC50 = 34. Although this does reveal considerable variation among British Columbia's mills and no doubt results in significant differences between British Columbia's mills and mills located in other parts of Canada, these differences are not considered to be great enough to seriously distort the total toxicity loadings estimates for Canada. Nonetheless, comparisons that are made for the purpose of assessing the quality of the toxicity effluent would not be valid.

Even though the toxicity data as presented are considered reasonably reliable in order of magnitude or quantity, the precise accuracy of the information presented depends on the number and frequency of tests taken. This also varies greatly among regions. All mills in British Columbia were tested in 1985. All mills except three in Ontario were tested in either 1984 or 1985. All prairie mills except one were tested in either 1984 or 1985. Of the nineteen direct discharge mills located in the Atlantic, five were not tested in either 1984 or 1985. Fourteen of Quebec's 47 direct discharge mills were not tested in either 1984 or 1985. Despite this seemingly overwhelming distortion in the information available, it should be noted that there is a paucity of testing for mills that are generally known to be toxic because of the processes being used. These same mills are usually very small producers, which makes it economically difficult for them to adopt the necessary environmental procedures. Since these mills are assumed to have toxic effluent and their discharges are calculated into the total toxicity loadings estimates contained in this report, the overall magnitude of the toxic discharge loadings are considered reasonably accurate.

Estimates on air contaminants emissions from anthropogenic sources have been developed and published by Environmental Protection in Ottawa for many years. In most instances, the data contained in these publications do not provide an accurate indication of air emission trends, because of variations in data collection techniques and calculation methodologies. However, in September 1986, a report was prepared that put all the existing information available at the time on a consistent footing to provide what are considered to be reasonably accurate trends on emission discharges according to source for the period 1970 to 1980. Additional estimates were provided by Environmental Analysis Branch in Ottawa to provide trend information on air emissions to 1986.

The capital investment information for pollution control machinery and equipment was obtained from the CPPA. These data are gathered by the CPPA in an annual survey of mills in the industry. The CPPA annual survey is not a sample survey, but includes all of the more than 98 percent of the industry with membership in the Association. Therefore, it seems reasonable to expect that the data does cover the total of the industry. The main problem with CPPA's capital investment information is the very considerable room that exists for differences in interpretation as to what actually constitutes a pollution related investment. There is no question that this causes problems that almost certainly would lead to some potential inaccuracies. These potential inaccuracies have been pointed to when comparisons are made between industry estimates and estimates calculated on the basis of accelerated capital allowance information. Nonetheless, when all factors are taken into account, and the obvious shortcomings of the accelerated capital allowance information are considered, it becomes obvious that only those responsible for purchasing machinery and equipment are in a position to specify the reason for their investments. The CPPA appears to go to considerable lengths to ensure that the estimates provided by the mills are made on a common basis and applied consistently from one year to the next. When examined in the context of similar information provided by Statistics Canada on capital stock accumulation within the industry, and on industry wide investment information from other sources, the CPPA data appears reasonably consistent.

Overall Quality of Data Used

As is true in virtually every assessment that is based on information gathered by different groups, compiled using alternative formats and used for a variety of purposes, the data used in the report contains flaws. Nonetheless, the excellent cooperation received from provincial agencies, mill representatives and industry associations has helped to ensure that the data used are the best currently available. There are not very many industries that, through organisations like the CPPA, report on their activities so consistently or in such detail in annual publications. Not many industries have been subject to environmental regulations for as long a period of time as the pulp and paper industry. As a result, not many industries have been monitored as closely, or devoted as much time to documenting the environmental controls adopted at individual mills. Therefore, despite all the limitations and cautionary remarks provided above, it is felt that the information contained in this report is appropriate to the analysis that is undertaken. It is consistent with the current state of knowledge about the industry. More importantly, it reflects well on the combined efforts of government and industry in coping with the complex problems encountered when trying to maintain a clean healthy environment for Canadians.

ADDENDUM APPENDIX I

Individuals and Organisations Included in Survey - 1986

Company	Contact and Location
Abitibi-Price Inc.	Pierre Veilleux, Manager Environmental & Tech. Services Gilles Roy Environmental Engineer Quebec City, P.Q.
	Brian Young Manager of Environmental Control Mississauga, Ont.
	Al Duff, Pulping Superintendent Dave Radbury, Mgr. Environment Sam Pollate, Paper Supervisor Al Windgate Bruce Hansen Pine Falls, Man.
B.C. Forest Products	Bill Clarke, Mill Manager John Morgan, Tech. Superintendent Derik Hill, Asst. Tech. Supervisor Arvind Thakory, Envir. Engin. Crofton, B.C.
Boise Cascade Cda. Ltd.	John Valley VP Corporate Affairs Mississauga, Ont.
Bowater Mersey Paper Co. Ltd.	Harold Dobson, Asst. Gen. Manager John Hopkins, General Office Fred Griffin, Production Warren Kelly, Environ. Engineer Brooklyn, N.S.
Canadian Forest Products	Kim Lentz Environmental Control Technologist Prince George, B.C.

Company	Contract and Location
Champion Forest Products	Bill Gunning, Asst. Tech. Supt. Todd Andrews, Asst. Tech. Supt. Hinton, Alta.
CIP	Francois Nicolle Director Environmental Services Montreal, P.Q.
	Victor Li Technical Control Superintendent Chester, N.S.
	Jerry Winiski, Superintendent Technical Department Gordon Taylor, Manager Technical Services Gold River, B.C.
Consolidated-Bathurst Inc.	Tom Savoy, Chief Engineer Lionel Chartier, Mgr. Envir. Serv. Sveta Petrovic, Asst. Chief Engin. Montreal, P.Q.
E.B. Eddy	Don Hall Ottawa, Ont.
	Doug McMullan, VP & Mill Manager Sekar Chandrasekaran, Tech. Dir. Roger Cook Dave Howard Esponola, Ont.
Fraser Inc.	Dave Kerr, VP Technology Dave Bishop, Manager, EP Rick Brown, Aerometric Prog. Super. Edmundston, N.B.
Great Lakes Forest Ltd.	Albert Brule, Mgr. Environ. Serv. Po Wong, Water Quality Super. Thunder Bay, Ont.
Irving Pulp & Paper Ltd.	Carl Gorham, General Manager Martin Cyr, Technical & Environmental Manager Saint John, N.B.

Company	Contact and Location
MacMillan Bloedel Ltd.	Al Chemelaukas, Director Environmental Control, Corporate Level for Manufacturing Vancouver, B.C.
Noranda	Serge Farand Director of Environment Masson, P.Q.
Northwood Pulp and Timber ltd.	Bill Matson, Vice President Bob Wiseman, Technical Director Lloyd Clay, Manufacturing Manager Jack Nyland, Environ. Control Lab Prince George, B.C.
Ontario Paper Co.	Ross Williams Director, Envirnmental Affairs Bill Fell Thorold, Ont.
Proctor & Gamble Cellulose Ltd.	Steve Howes Environmental Manager Grande Prairie, Alta.
Reed Paper Ltd.	Bruce Henderson, Mgr. of Resources Conserv. - Energy & Environment Jean-Mark Arial Mario Goulet Quebec City, P.Q.
St. Mary's Paper Co.	Lori Tuttle Technical Assistant Environment Sault Ste. Marie, Ont.
Scott Paper Ltd.	Ken Herron Production Manager New Westminster, B.C.
Western Pulp Inc.	Bill Rempel Manager Technical & Environmental Serv. Squamish, B.C.

Company	Contact and Location
Weyerhaeuser Canada	Bob Ryan, Manager Technical Services John Zagas Environmental Supervisor Kamloops, B.C.
	Alan Twa Technical Superintendent Tony Kaptein Environmental Supervisor Prince Albert, Sask.

Province	Contact and Location
Alberta	Akio Masuda, Head Water Quality Control Branch Environment Pollution Control Div. Paul Shewchuk, Chief Scientific Off. Water Quality Control Branch Environment Standards and Approvals Division Edmonton, Alta.
British Columbia	Bob Ferguson, Director, Waste Management Branch Ministry of Environment Dave Morrison, Techical Advisor, Technical Services Section, Waste Management Branch Victoria, B.C.
Manitoba	Carl Orcutt, Director Larry Strachan, Chief Environmental Control Services Clem Moche, Environmental Engineer Mike Van Den Bosch, Envir. Engineer Environment and Workplace, Safety and Health Winnipeg, Man.
New Brunswick	Dave Silliphant, Director Environmental Protection Branch Dave Macrae, Air Jim Shaffner, Water Fredericton, N.B.

Province	Contact and Location
Newfoundland	Dave Jeans, ADM, Water Poll. Programs Les Hulett, Industrial Programs John Neate, District Director C&P John Newhook, Industrial Programs St. John's, Nfld.
Nova Scotia	Derrill Hynick, Chief Waste Management Art Crouse, Director Inspection and Monitoring Dave Gates, Environmental Halifax, N.S.
Ontario	Walter Suboch, Co-ordinator, Industrial Organics Industrial Wastewater Unit Water Resources Branch Ministry of Environment Toronto, Ont.
Quebec	Claude Lavallee Andre Grondin Ministry of Environment Quebec City, P.Q.
Saskatchewan	Don Fast, Director Water Pollution Control Branch Saskatchewan Environment and Public Safety Darryl Nargang, Asst. Director Water Quality Br., Standards and Approval Section Bob Schutzman, Supervisor, Water Quality Br., Standards and Approvals Section John Harrison Regina, Sask.

APPENDIX II

DIRECT DISCHARGE PULP AND PAPER MILLS IN CANADA ACCORDING TO REGION - 1986

APPENDIX II

DIRECT DISCHARGE PULP AND PAPER MILLS IN CANADA ACCORDING TO REGION - 1986

ATLANTIC

Abitibi-Price Inc.
Grand Falls, Nfld.

Bowater Mersey Paper Co. Ltd.
Liverpool, N.S.

Corner Brook Pulp and Paper Ltd.
Corner Brook, Nfld.

Abitibi-Price Inc.
Stephenville, Nfld.

NBIP Forest Products Inc.
Dalhousie, N.B.

Rothesay Paper Ltd.
Saint John, N.B.

Irving Pulp and Paper Ltd.
Saint John, N.B.

Miramichi Pulp and Paper Inc.
Newcastle, N.B.

St. Anne-Nackawic Pulp and Paper Co. Ltd.
Nackawic, N.B.

Scott Maritimes Ltd.
Abercrombie Pt., N.S.

Fraser Inc.
Edmunston, N.B.

Fraser Inc.,
Restigouche Div.
Atholville, N.B.

Stora Forest Industries
Point Tupper, N.S.

Consolidated-Bathurst Inc.
Bathurst, N.B.

Lake Utopia Paper Ltd.
Utopia, N.B.

Miramichi Pulp and Paper Inc.
Nelson-Miramichi, N.B.

CKF Inc.
Hantsport, N.S.

Canexel Hardboard Inc.
East River Plant
Chester, N.S.

Minas Basin Pulp and Paper
Co. Ltd.
Hantsport, N.S.

QUEBEC

La Compagnie Gaspesia Ltee.
Chandler, Que.

The Price Company Ltd.
Alma, Que.

Consolidated-Bathurst Inc.
Belgo Division
Shawinigan, Que.

Cascade (Jonquiere) Inc.
Jonquiere, Que.

CIP Inc.
Gatineau, Que.

CIP Inc.
Trois-Rivieres, Que.

Kruger Inc.
Bromptonville, Que.

F.F. Soucy Inc.
Riviere-du-Loup, Que.

Consolidated-Bathurst Inc.
Laurentide Division
Grand Mere, Que.

Consolidated-Bathurst Inc.
Port Alfred Division
Ville de la Baie, Que.

Domtar Inc.
Dolbeau, Que.

Donohue Charlevoix Inc.
Clermont, Que.

James Maclaren Industries Inc.
Masson, Que.

Papeterie Reed Ltee.
Quebec, Que.

Q.N.S. Paper Co. Ltd.
Baie Comeau, Que.

Consolidated-Bathurst Inc.
Wayagamack Division
Trois Rivieres, Que.

The Price Company Ltd.
Beaupre, Que.

The Price Company Ltd.
Kenogami, Que.

Domtar Inc.
Donnacona, Que.

Donohue Normick Inc.
Amos, Que.

Kruger Inc.
Three Rivers Mill
Trois Rivieres, Que.

Mohawk Pulp Co. Ltee.
Chemin du Lac, Que.

Mohawk Pulp Co. Ltee.
Riviere-du-Loup, Que.

Building Products of Canada Ltd.
Pont-Ronge, Que.

Cascades (East Angus) Inc.
East Angus, Que.

CIP Inc.
La Tuque, Que.

Consolidated-Bathurst Inc.
Pontiac Division
Portage-du-Fort, Que.

Domtar Inc.
Windsor, Que.

Domtar Inc
Lebel-sur-Quevillon

Donohue St-Felicien Inc.
St-Felicien, Que.

James Maclaren Industries Inc.
Thurso, Que.

Tembec Inc.
Temiscaming, Que.

Papier Cascades (Cabano) Inc.
Cabano, Que.

CIP Inc.
Matane, Que.

Consolidated-Bathurst Inc.
Chaleurs Division
New Richmond, Que.

Domtar Inc.
Beauharnois, Que.

E.B. Eddy Forest Products Ltd.
Hull, Que.

Price Wilson Inc.
Lachute, Que.

Rolland Inc.
Mont Rolland, Que.

Rolland Inc.
St. Jerome, Que.

J. Ford & Co. Limited
Portneuf Station, Que.

Scott Paper Ltd.
Eastern Mfg. Division
Crabtree, Que.

Scott Paper Ltd.
Lennoxville, Que.

St. Raymond Paper 1983 Inc.
St. Leonard, Que.

La Compagnie du Gypse du Cda. Ltd.
Joliette, Que.

Les Industries Cascades Ltee.
Kingsey Fall, Que.

Les Materiaux Cascades Inc.
Louisville, Que.

ONTARIO

Abitibi-Price Inc.
Iroquois Falls, Ont.

Boise Cascade Canada Ltd.
Kenora, Ont.

Great Lakes Forest Products
Thunder Bay, Ont.

Abitibi-Price Inc.
Fort William Division
Thunder Bay, Ont.

E.B. Eddy Forest Products Ltd.
Espanola, Ont.

James River-Marathon Ltd.
Marathon, Ont.

Boise Cascade Canada Ltd.
Fort Frances, Ont.

Domtar (Packaging) Inc.
Red Rock, Ont.

Domtar (Packaging) Inc.
Trenton, Ont.

Fraser Inc.
Thorold, Ont.

Kimberly-Clark of Canada Ltd.
St. Catherines, Ont.

The Beaver Wood Fibre Co. Ltd.
Thorold, Ont.

Paperboard Industries Corporation
Trenton, Ont.

Strathcona Paper Company
Strathcona, Ont.

The Ontario Paper Co.
Thorold, Ont.

Spruce Falls Power & Paper Co. Ltd.
Kapuskasing, Ont.

Abitibi-Price Inc.
Thunder Bay, Ont.

St. Mary's Paper Inc.
Sault Ste. Marie, Ont.

Abitibi-Price Inc.
Smooth Rock Falls, Ont.

Great Lakes Forest Products Ltd.
Dryden, Ont.

Kimberly-Clark of Canada Ltd.
Terrace Bay, Ont.

Domtar Inc.
Cornwall, Ont.

Domtar Inc.
St. Catherines, Ont.

MacMillan Bloedel Ltd.
Sturgeon Falls, Ont.

E.B. Eddy Forest Products Ltd.
Ottawa, Ont.

Kimberly-Clark of Canada Ltd.
Huntsville, Ont.

Domtar Inc.
Construction Materials Group
Thorold, Ont.

Provincial Papers
Port Arthur Division
Thunder Bay, Ont.

PRAIRIES

Abitibi-Price Inc.
Pine Falls, Man.

Weyerhaeuser Canada Ltd.
Prince Albert Pulp & Paper
Prince Albert, Sask.

Manfor Ltd.
The Pas, Man.

Proctor & Gamble Cellulose Ltd.
Grande Prairie, Alta.

Champion Forest Products (Alta) Ltd.
Hinton, Alta.

PACIFIC

Crown Forest Industries Ltd.
Elk Falls Mill
Campbell River, B.C.

British Columbia Forest Products Ltd.
Crofton, B.C.

British Columbia Forest Products Ltd.
Mackenzie, B.C.

Cariboo Pulp & Paper Co.
Quesnel, B.C.

Crestbrook Forest Industries Ltd.
Skookumchuck, B.C.

Intercontinental Pulp Co. Ltd.
Prince George, B.C.

Northwood Pulp & Timber Ltd.
Prince George, B.C.

Power Corporation & China Pulp
Celgar Pulp Mill
Castlegar, B.C.

Western Pulp Limited
Squamish, B.C.

Belkin Paperboard
New Westminster, B.C.

Quesnel River Pulp Company
Quesnel, B.C.

Scott Paper Ltd.
New Westminster, B.C.

MacMillan Bloedel Ltd.
Powell River, B.C.

MacMillan Bloedel Ltd.
Alberni Pulp & Paper
Port Alberni, B.C.

Canadian Forest Products Ltd.
Howe Sound Pulp Division
Port Mellon, B.C.

CIP Forest Products Inc.
Gold River Pulp Mill
Gold River, B.C.

Eurocan Pulp and Paper Co.
Kitimat, B.C.

MacMillan Bloedel Ltd.
Nanaimo, B.C.

Prince George Pulp & Paper Ltd.
Prince George, B.C.

Skeena Cellulose Inc.
Prince Rupert, B.C.

Western Pulp Limited
Port Alice, B.C.

Weyerhaeuser Canada Ltd.
Kamloops, B.C.

Finlay Forest Industries Ltd.
Mackenzie, B.C.

APPENDIX III

PULP AND PAPER COMPANY AND MILL ENTERPRISE OWNERSHIP IN CANADA - 1988

APPENDIX III

PULP AND PAPER COMPANY AND MILL ENTERPRISE OWNERSHIP IN CANADA[1] - 1988

Company/Enterprise	Ownership[2]	Percentage Control
Abitibi-Price	Olympia & York (C)	78
	Public	22
Acadia Forest	Repap Enterprises (C)	100
Atlantic Packaging	Private	
Beaver Wood	Georgia-Pacific (A)	100
Belkin Packaging	Paperboard (C)	100
Boise Cascade Canada	Boise Cascade (A)	100
Bowater Mersey	Washington Post (A)	49
	Bowater (A)	51
British Columbia Forest Products	Fletcher Challenge (O)	69
	Public	31
Canfor Corp.	Family	54
	Public	46
Cariboo	Weldwood (A)	50
	Marubeni/Daishowa (J)	50
Cascades	Management	65
	Public	35
Cascades (Port Cartier)	Cascades (C)	50
	Rexfor	50

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[1] This information is taken from newspaper and trade journal articles and compiled in cooperation with J.D. Rowland of the Canadian Paper Analyst (the main source of the information). The information is considered accurate as of May 1988.

[2] The designation A, B, C, J, O refer to the country of company or business enterprise origin. A refers to the USA, B to Britain, C to Canada, J to Japan and O to other countries. Private indicates private or personal ownership regardless of the form of legal entity. Public refers to publicly owned shares owned by individual investors.

Company/Enterprise	Ownership[2]	Percentage Control
Cascades (Cabano)	Cascades (C)	95
	Private	5
Celgar Pulp (ex-Westar)	Cons-Bathurst (C)	25
	Power Corp. (C)	25
	Chinese Gov. (O)	50
CIP	Canadian Pacific (C)	100
Consolidated Bathurst	Assoc. Newspapers (B)	15
	Power Corp. (C)	40
	Public	45
Crestbrook	Honshu (J)	32
	Mitsubishi (J)	32
	Public	36
Crown Forest	Fletcher Challenger (O)	100
Domtar	Quebec Government	44
	Public	56
Donohue	Quebecor (C)	28
	Maxwell Comms. (B)	27
	Public	45
Charlevoix	Donohue (C)	55
	Gannett (A)	45
Malbaie	Donohue (C)	51
	New York Times (A)	49
Donohue Normick	Donohue (C)	58
	Normick Perron (C)	42
Donohue St. Felicien	Donohue (C)	55
	B.C. Forest (C)	45
E.B. Eddy	George Weston (C)	100
Eurocan	Enso-Gutzeit (O)	50
	West Fraser Timber (A)	50
Fibreco	Private	
Finlay Forest	B.C. Forest (O)	50
	Royal Bank (C)	50

Company/Enterprise	Ownership[2]	Percentage Control
Ford	Private	
Fraser	Noranda Forest (C)	100
Gaspesia	Abitibi-Price (C)	51
	New York Times (A)	49
Glassine Canada	Private (A)	
Great Lakes	Canadian Pacific (C)	54
	Public	46
Howe Sound[3]	Canfor (C)	50
	Oji (J)	50
Intercontinental	Canfor Corp. (C)	100
Irving	Private	
Island Paper	MacMillan Bloedel (C)	50
	Noranda Forest (C)	50
James River - Marathon	James River (A)	80
	Buchanan Forest (C)	20
Kimberly Clark	Kimberly Clark (A)	100
Kruger	Private	
Lake Utopia	Irving (C)	100
MacLaren	Noranda Forest (C)	100
MacMillan Bloedel	Noranda Forest (C)	50
	Public	50
Manfor	Manitoba Government	100
Marlboro	Private	
Millar Western	Private	
Minas Basin	Private	
Miramichi	Repap Ent. (C)	100
Mohawk	St. Raymond	100

Company/Enterprise	Ownership[2]	Percentage Control
NBIP	CIP (C)	67
	Oji (J)	25
	Mitsui (J)	8
Noranda Forest	Noranda Inc. (C)	82
	Public	18
Northwood	Noranda Forest (C)	50
	Mead (A)	50
Paperboard	Kinburn (C)	100
Perkins	Management	79
	Public	21
Prince Albert	Weyerhaeuser (A)	100
Prince George	Canfor Corp. (C)	100
Procter & Gamble	Procter & Gamble (A)	100
Quebec & Ontario Paper	Tribune (A)	100
Quesnel River	West Fraser (A)	50
	Daishowa (J)	50
Reed	Daishowa (J)	100
Repap Ent.	Management	95
	Public	5
Rolland	Family	57
	Cascades (C)	35
	Public	8
Rothesay Paper	Irving (C)	100
St. Anne Nackawic	Parsons & Wittemore (A)	100
St. Mary's Paper	Rauma Repola (O)	25
	Private (A)	75
St. Raymond	Private	
Scott Paper	Scott Paper (A)	50
	Public	50
Scott Maritimes	Scott Paper (A)	100

Company/Enterprise	Ownership[2]	Percentage Control
Skeena Cellulose (ex-Westar)	Repap Ent. (C)	100
Sonoco	Sonoco (A)	100
Soucy	Bato (A)	100
F.F. Soucy et Associes	Soucy (A)	50
	Dow Jones (A)	40
	Rexfor (C)	10
Spruce Falls	Kimberly Clark (A)	51
	New York Times (A)	49
Stora Forest	Stora Kopparbergs (O)	100
Strathcona	Roman Corp. (C)	100
Tembec	Public	55
	Rexfor (C)	20
	Repap (C)	10
	Private	15
Waferboard	Family	56
	Public	44
Weldwood	Champion International	85
	Public	15
West Fraser	Family	70
	Public	30
Western Pulp	Two Banks	43
	B.C. Forest (C)	19
	Whonnock (C)	19
	Doman (C)	19
Weyerhaeuser	Weyerhaeuser (A)	100

APPENDIX IV

U.S. SULPHITE MILLS PRODUCTION, AGE OF MILLS, POLLUTION TREATMENTS AND CONTROLS USED, AND PROCESS BASE - 1988

APPENDIX IV

UNITED STATES SULPHITE PULP MILLS - JANUARY 1988

STATE	NAME/MILL LOCATION	AGE	TYPE/PULP PRODUCTION (T/DAY)	PROCESS BASE[3]	ENVIRONMENT CONTROLS
Alaska	Alaska Pulp - Sitka	1959	Dissolving Sulphite (622)	Mg	P, b[1], AS
	Louisiana-Pacific - Ketchikan	1952	Dissolving Sulphite (692)	Mg	P, AS
Florida	ITT Rayonier - Fernandina Beach	1939	Dissolving Sulphite (492)	NH3	P, ASB
Maine	Great Northern - Millinocket	1900	Sulphite (841), Groundwood (962)	Mg	P, ASB
New York	Finch-Pruyn - Glens Falls	1905	Sulphite (449)	NH3	P, AS
Pennsylvania	Procter & Gamble - Mehoopany	1966	Sulphite[2]	NH3	P, AS
Washington	Georgia-Pacific - Bellingham	1928	Sulphite (618), Semichem (54)	Ca	P, ASB
	ITT Rayonier - Hoquiam	1929	Sulphite (365)	Na	P, AS
	ITT Rayonier - Port Angeles	1930	Dissolving Sulphite (529)	NH3	P, AS
	James River - Camas	1883	Bl Kraft (1070), Sulphite (540)	Mg	P, ASB
	Scott Paper - Everett	1932	Sulphite (518), Groundwood (32)	NH3	P, AS
	Weyerhaeuser - Cosmopolis	1957	Dissolving Sulphite (503)	Mg	P, AS, ASB
Wisconsin	Badger Paper Mills - Peshtigo	1921	Sulphite (92)	NH3	P, ASB
	Flambeau Paper - Park Falls	1898	Sulphite (112)	Ca	P, AS
	Nekoosa Papers - Port Edwards	1906	Sulphite (248)	Mg	P, OAS
	James River - Green Bay	1900	Sulphie (137)	Ca	P, M
	Wausau Paper Mills - Brokaw	1899	Sulphite (175)	Mg	P, AS
	Weyerhaeuser - Rothschild	1909	Sulphite (199)	Ca	P, AS

[1] An anaerobic contact process is under design and construction.
[2] Pulp production is confidential, total tissue production is 750 T/D.
[3] P = Primary Treatment: ASB = Aerated Stabilisation Basin: OAS = Activated Sludge: OAS = Oxygen Activated Sludge: M = By-product Production: Na = Sodium: Mg = Magnesium: NH3 = Ammonium: Ca = Calcium

Source: Presented with permission of the Environmental Protection Agency, Seattle, Washington.

APPENDIX V

REGIONAL AND DISTRICT OFFICES OF CONSERVATION AND PROTECTION AND ENVIRONMENTAL PROTECTION

APPENDIX V

REGIONAL AND DISTRICT OFFICES OF CONSERVATION AND PROTECTION AND ENVIRONMENTAL PROTECTION

I) ATLANTIC REGION

Regional Office:
5th Floor, Queen Square
45 Alderney Drive
Dartmouth, Nova Scotia
B2Y 2N6
Dex: 902-426-2690

Director General: J.E. Vollmershausen
Phone: 902-426-7155

Regional Director: E.J. Norrena
Phone: 902-426-3593

District Offices:
Newfoundland:
P.O. Box 5037
St. John's, Newfoundland
A1C 5V3
Dex: 709-772-5097

District Director: J. Neate
Phone: 709-772-5488

New Brunswick:
P.O. Box 400, Queen Street
Fredericton, New Brunswick
E3B 4Z9
Dex: 506-452-3003

District Director: J. de Gonzague
Phone: 506-452-3286

Prince Edward Island:
P.O. Box 426, Dominion Building
97 Queen Street
Charlottetown, Prince Edward Island
C1A 7K7
Dex: 902-566-7531

District Director: A. Hiscock
Phone: 902-566-7042

Nova Scotia:
5151 Terminal Road
5th Floor
Halifax, Nova Scotia
B3R 2B9
Dex: 902-426-5602

A/District Director: I.C. Travers
Phone: 902-426-5601

II) QUEBEC REGION

Regional Office: 1141 Route de L'eglise
P.O. Box 10100
Sainte-Foy, Quebec
G1V 4H5
Dex: 418-648-4613

Director General: J.P. Gauthier
Phone: 418-648-4077

District Office: 1179, rue de Bleury
2nd Floor
Montreal, Quebec
H3B 3H9
Dex: 514-283-4423

Regional Director: G. Mezzetta
Phone: 514-283-0178

III) ONTARIO REGION

Regional Office: 25 St. Clair Avenue East
Toronto, Ontario
M4T 1M2
Dex: 416-973-8342

Director General: E. Dowdeswell
Phone: 416-973-8636

Regional Director: K. Shikaze
Phone: 416-973-1055

IV) WESTERN AND NORTHERN REGION

Regional Office: Twin Atria No. 2, 2nd Floor
4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3
Dex: 403-420-2615

Director General: B. Burns
Phone: 403-468-8065

Regional Director: R.K. Lane
Phone: 403-468-8041

District Offices: Alberta:
Twin Atria No. 2, 2nd Floor
4999 - 98 Avenue
Edmonton, Alberta
T6B 2X3
Dex: 403-420-2615

District Manager: R. Orr
Phone: 403-468-8007

IV) WESTERN AND NORTHERN REGION (Cont'd)

District Offices: Saskatchewan:
2nd Floor, 1901 Victoria Avenue
Regina, Saskatchewan
S4P 3R4
Dex: 306-780-6466

District Manager: J. Witteman
Phone: 306-780-6390

Manitoba:
5th Floor, 269 Main Street
Winnipeg, Manitoba
R3C 1B2
Dex: 204-983-4506

District Manager: B. Briscoe
Phone: 204-983-4811

V) PACIFIC AND YUKON REGION

Regional Office: 3rd Floor, Kapilano 100 - Park Royal
West Vancouver, British Columbia
V7T 1A2
Dex: 604-666-6281

Director General: D.K. Dawson
Phone: 604-666-5881

Regional Director: B.A. Heskin
Phone: 604-666-0064

District Office: Yukon:
Room 225, Federal Building
308 Main Street
Whitehorse, Yukon
Y1A 2B5
Dex: 403-667-7962

District Chief: G. Mackenzie-Grieve
Phone: 403-667-3401

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